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Oil Painting 3D Scene: A Desert Survival Game Environment

Chien Hui Jarvis

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Oil Painting 3D Scene

A Desert Survival Game Environment

Chien Hui Jarvis

A Thesis submitted in partial fulfillment of the requirements for the degree of:
Master of Fine Arts in Visual Communication Design
School of Design | College of Imaging Arts and Sciences
Rochester Institute of Technology
December 2015

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Abstract

Keywords: survival game, desert, hand-painted texture, environment

Oil Painting 3D Scene: A Desert Survival Game Environment is a hand-painted, stylized game level. The whole environment includes desert, animals, plants, rocks, small particle effects and a shack built in Unreal Engine.

This report outlines the whole production process, from the very beginning of visual development stage till completion, and illustrates my ideas, sketches, obstacles, tests, design choices, failures and successes, as well as technical specifics.

Introduction

The use of the desert environment has become a commonplace in the world of games. Based on my survey, most of them are shooting or action games with realistic art style. *Oil Painting 3D Scene* is meant to take a different approach to the art style and gameplay possibilities.

The design of the project has combined traditional 2D oil painting style with a 3D game environment. I would like to create a desert environment with hand-painted textures. It is a 3D environment; it would look like a 2D painting, but gamers can explore in the scene as a 3D-based game. This project was accomplished by using various 2D and 3D software such as Maya, headus-UVLayout-Pro, XNormal, ZBrush, and Photoshop, then built in Unreal Engine for shading, lighting, and rendering. To create a hand-drawn feeling, I did some 2D studies about color sample, hand-painted texture techniques and art fundamentals.

Instead of the gameplay as a shooting or action game, I would like to create my scene as a survival game. Gamers can explore with my painting art style and search the hints and clues in the environment to survive. It would be both interesting and educational, and create a new gaming experience compared to other games.

The thesis focuses only on the visual aspect. Programming and the user interface are not a component of the project.

Process

Thesis Parameters

Format: A real-time environment. Including ten different kinds of plants, two different kinds of animals, modular rocks and sand, and an abandoned shack. A camera movement video based on real-time game environment

Length: 1 minutes and 30 seconds

Target: 12 to 18 years old gamers who are interested in survival game

Software: Autodesk Maya, Pixologic ZBrush, headus-UVLayout-Pro, Adobe Photoshop, Adobe After Effects, Unreal Engine, Marmoset Toolbag

Concept and Visual Design

As a first step to accomplishing my thesis, I did lots of practice and research of 2D painting (Simblet, 2010. Aleksander, 2011. Carla, 2010. Greenway, 2011) to create the concepts and define the mood of my environment and styles of the creatures and animals, as figures 1 to 10 show.

In addition to the 2D practices and sketching, I went to Lamberton Conservatory, which is located in Rochester, New York, for desert plants researches and observations. I found the desert plants are often spiny and have tiny leaves that are rarely bright green. While some other desert plants are swollen with fleshy leaves, stems or roots. The colors of desert plants are usually dark olive green, forest green, rose brown, dark salmon, or pale green. Their flowers are commonly very bright and colorful, such as plum, orange red, light coral, etc.

Desert plants look, which is defined by their shape, features, and characters tend to be unique so as to one can differentiate easily between them and another plant originated from different climate zone, for instance, tropical zone. This close observation inspired me on pre-production process.



Figure 1: Desert concept painting



Figure 2: Underground concept painting



Figure 3: Desert fox concept and color palette

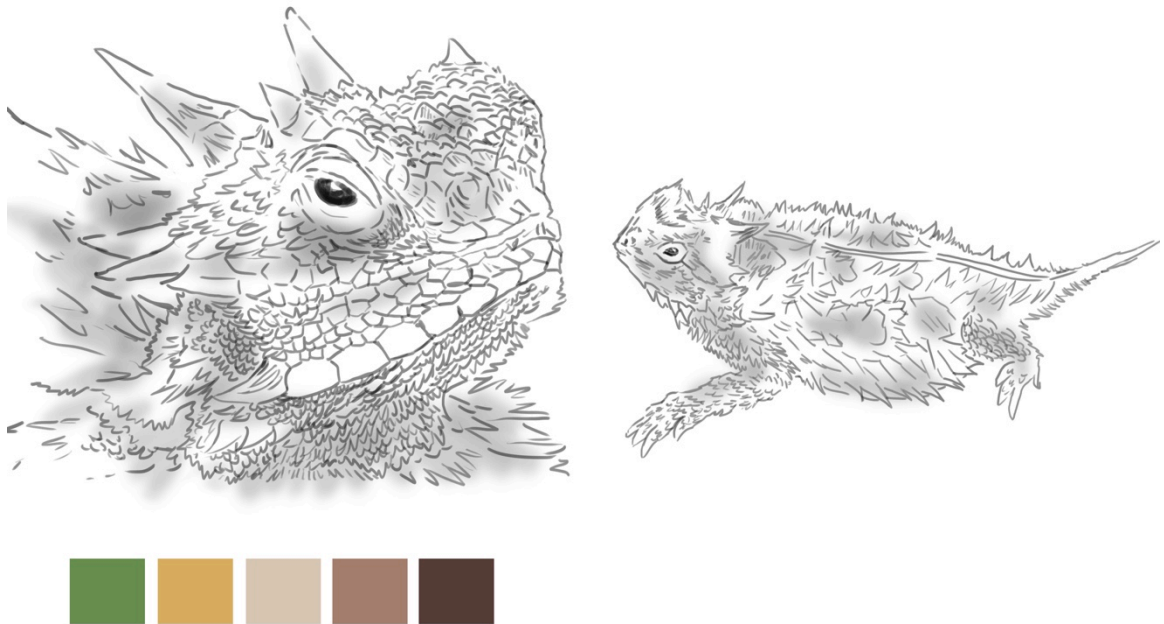


Figure 4: Desert lizard concept and color palette

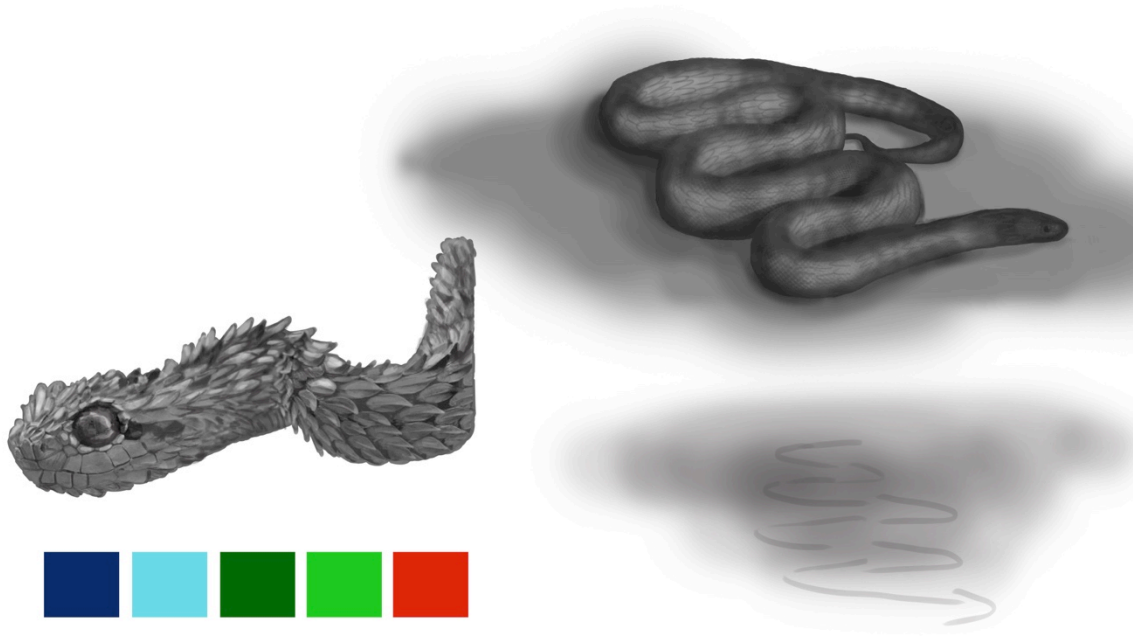


Figure 5: Desert snake concept and color palette



Figure 6: Desert spider concept and color palette

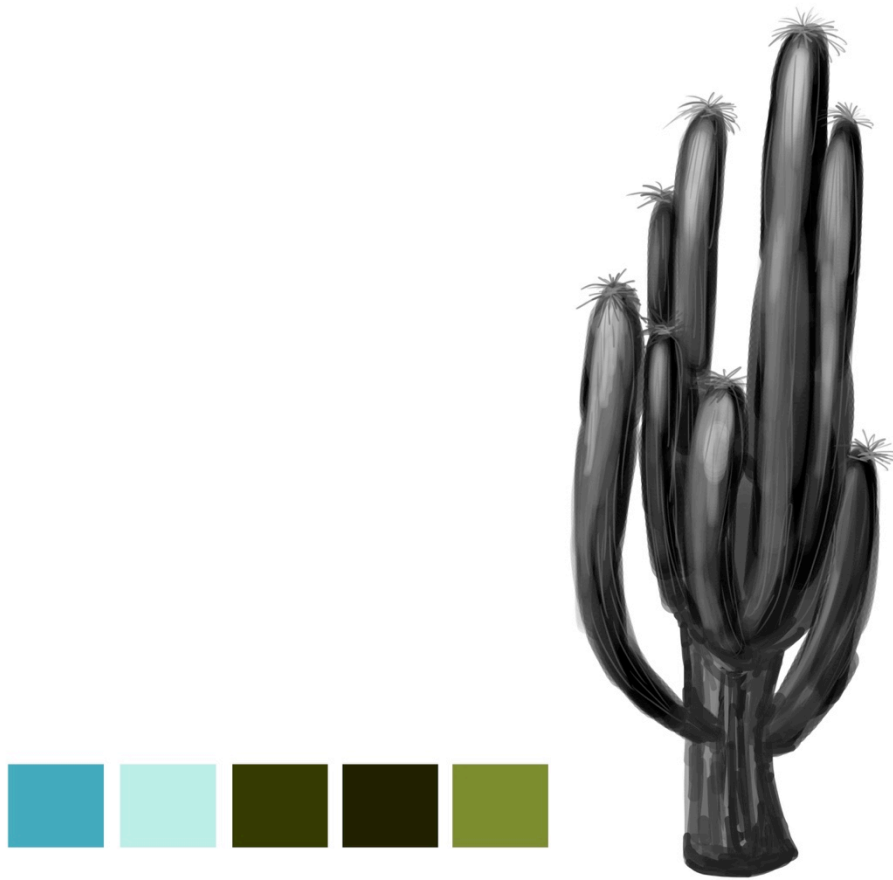


Figure 7: Cacti concept and color palette



Figure 8: Desert plants study

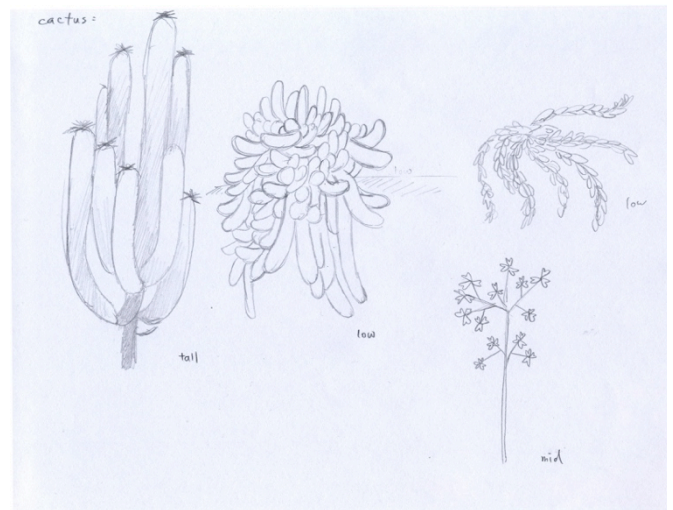


Figure 9: Desert plants study



Figure 10: Rocks concept experiment

After drawing several concepts and sketches, I felt my environment was too monotonous. I decided to create a human-made architecture instead of the underground world, which is different from my thesis proposal. The following images were the architectures concept sketches I drew, as figures 11 to 13 show.

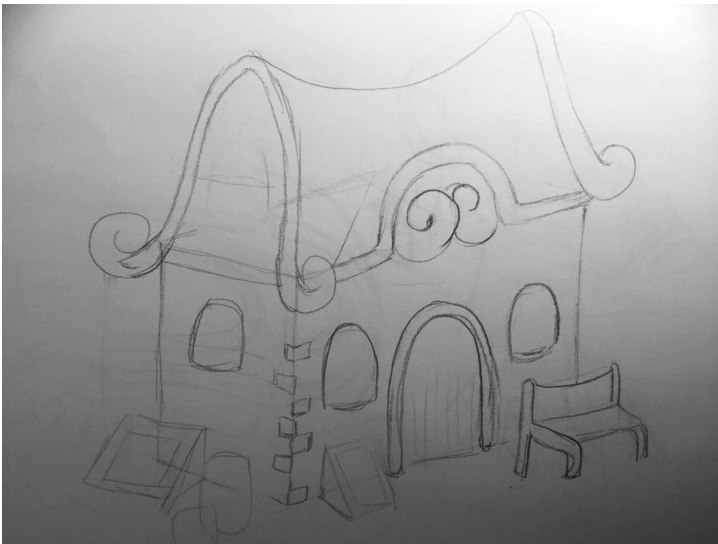


Figure 11: Architecture concept experiment



Figure12: Architecture concept experiment

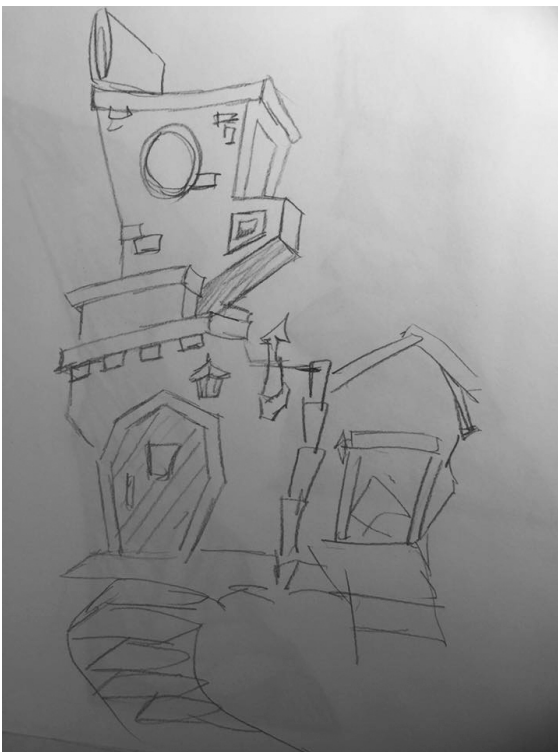


Figure 13: Architecture concept experiment

I tried to create a stylized, cartoony, and warm art style. I exaggerated the forms, shapes, and curves of the architecture, and modeled in Maya, textured in Photoshop, rendered and lighted in Unreal Engine, as figure 14 shows.

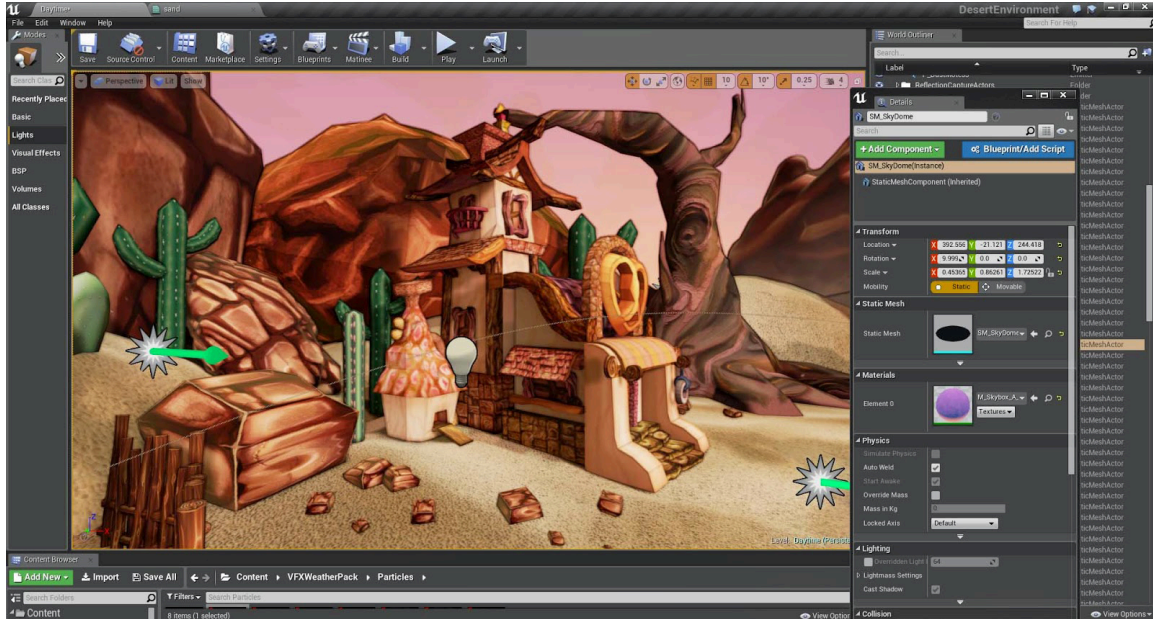


Figure14: architecture experiment rendering

After I had experimented the idea based on my sketches, I felt I achieved the cartoony style, however, the result was not as good as I expected to be, since the building was not in accordant with the desert environment. The cause of this mistake could be due to lack of research in desert architecture. This situation taught me a valuable lesson that planning and pre-production are vital, we cannot neglect any parts of this stage.

As figure 15 shows, after discussing with my thesis committee, I took one of my previous 3D works as reference.

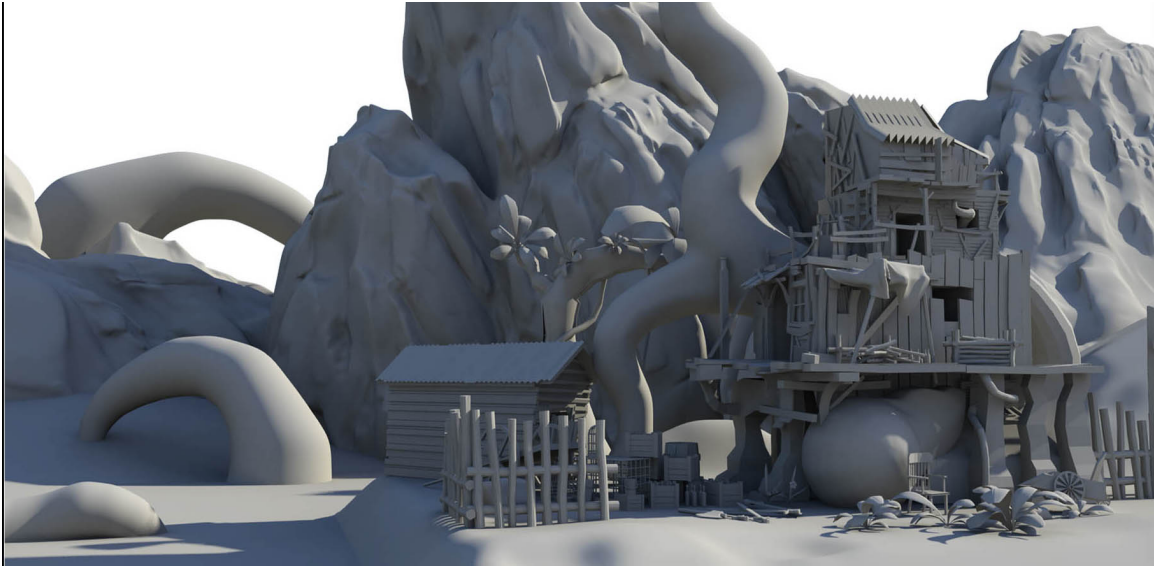


Figure 15: Shack concept from previous work

The other change of the visual was the shader of the water. At first, I applied the similar toon shader to it, and I thought the high-saturation color did not fit the environment well, as figure 16 shows. So I decided to apply the Unreal water shader, it contained the real water reflection and looked natural.



Figure 16: Cartoony water rendering

Game Props Creation

At the very early stage, I experimented different approaches of creating game props in Unreal Development Kit. There are two main ways of game-ready assets creation, one is from high-poly to low-poly; the other one is fully based on low poly.

Based on my research, high-poly to low-poly is a better approach than just building low-poly model in order to bake distinct maps for making physical-based shaders. I made the high-poly models first in ZBrush as figure 17 shows, then duplicated the model, decimated down the poly-count of the duplicated one. Then I used the ZRemesh for retypology, making much more low poly meshes for real-time render. Then projecting the high-poly details on the low-poly model, and Unwrapping the UVs of the low-poly model. The final process was exporting both high and low poly models, then baking all the maps I needed in XNormal and retouched the diffuse maps if needed in Photoshop. As figure 18 shows, I usually baked specular and normal maps.

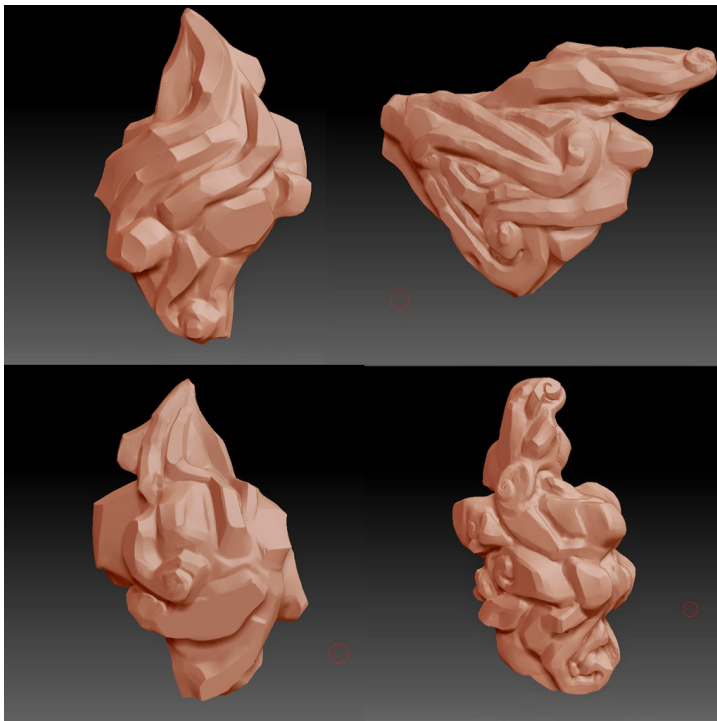


Figure 17: High-poly rocks in ZBrush

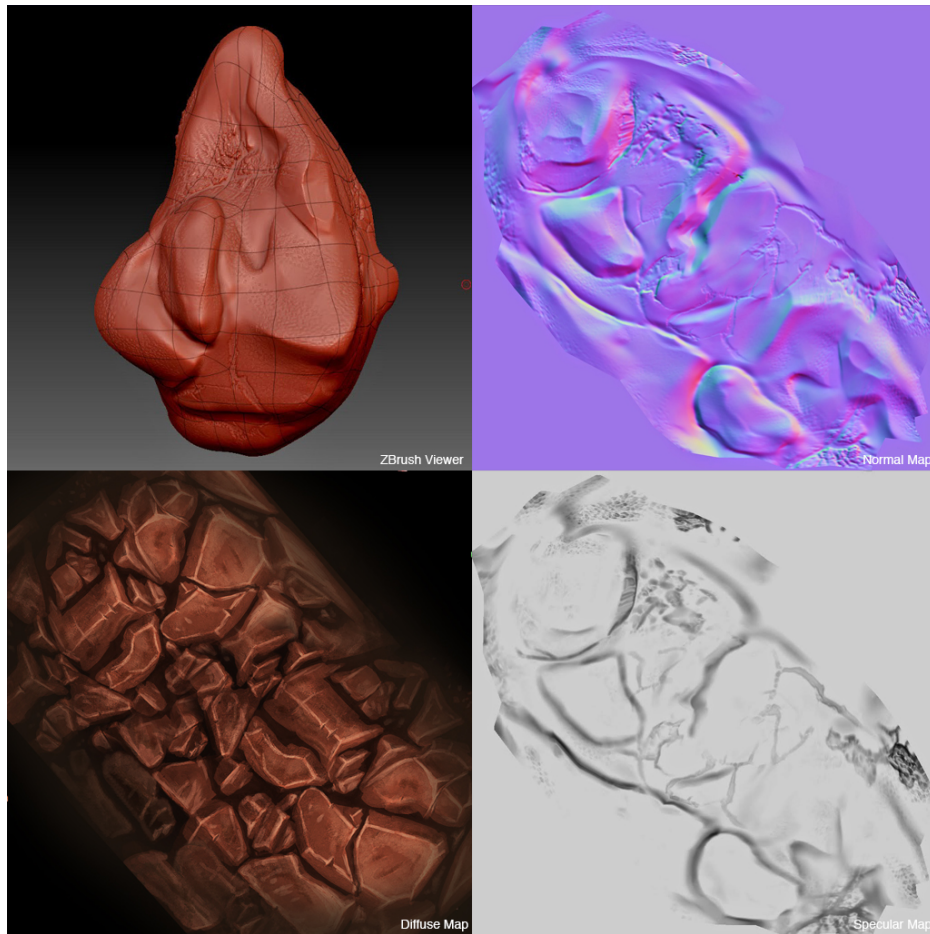


Figure 18: Normal and specular maps baking from XNormal, diffuse map from Photoshop

As figure 19 shows, I did a rendering experiment in Unreal Development Kit. The left rock was a simple shader with only diffuse map; the middle one was applied diffuse and specular maps, and the right one was applied diffuse, specular and normal maps.

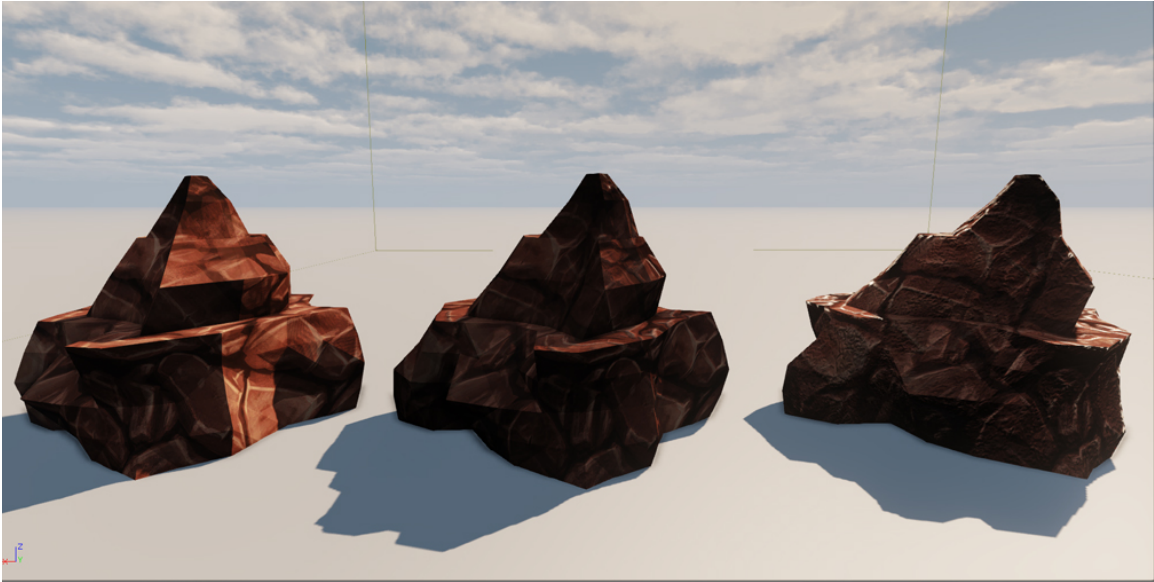


Figure 19: Experimenting different maps combination in Unreal Development Kit

After the experiment of the different texturing methods, I decided to make the diffuse-only materials, since it fit better with the cartoonish style. As figure 20 and 21 show, the following are the real-time rendering in Marmoset Toolbag.

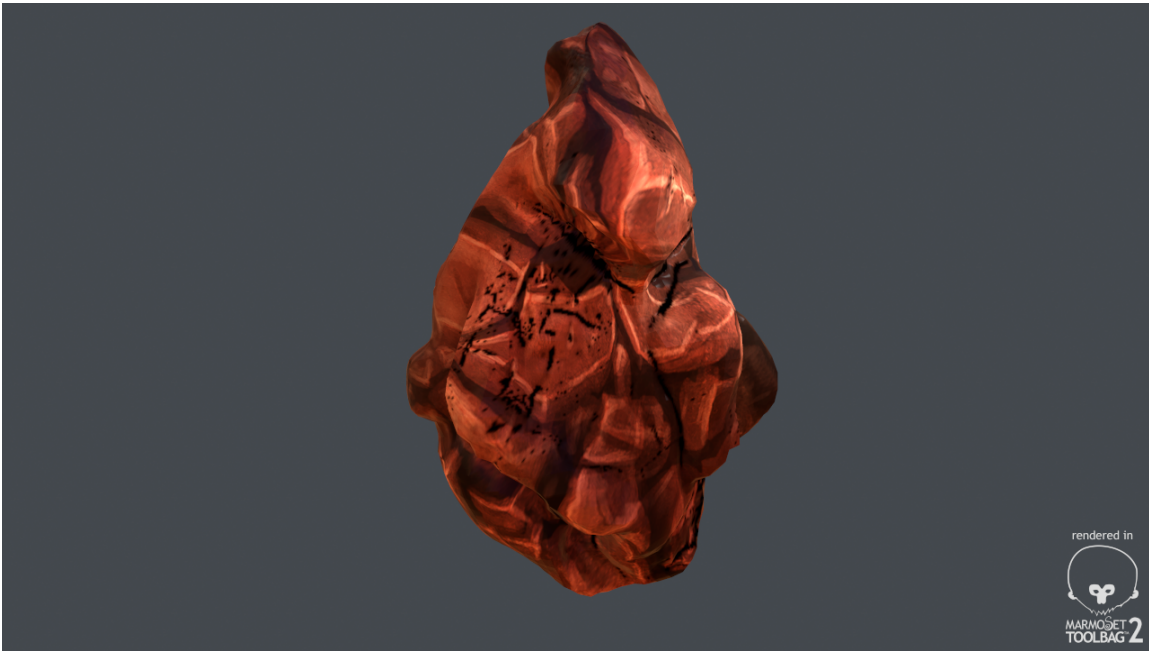


Figure 20: Diffuse only rendering in Marmoset Toolbag

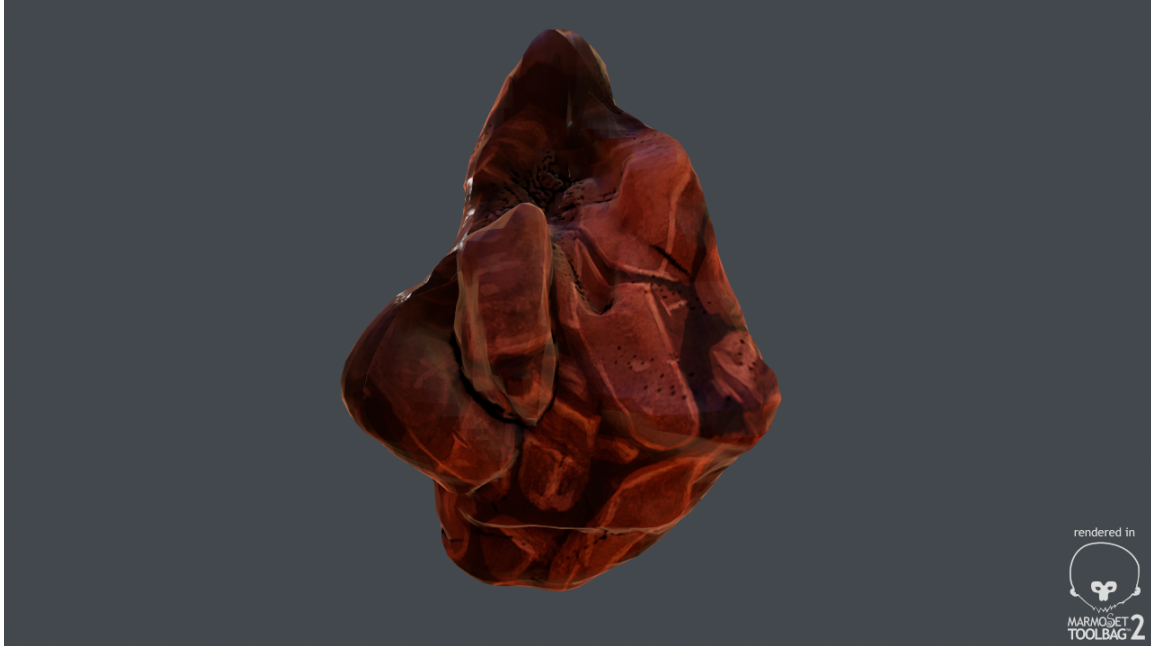


Figure 21: Diffuse only rendering in Marmoset Toolbag

Hand-painted Textures Creation

Hand-painted textures creation is the most important part of this project. I watched several tutorials online to practice and try to find the best approach of hand-painted textures. As figure 22 shows, the main practice focused on natural elements, such as stone, grass, wood, and skin.

When I started painting the texture, all I did first was blocking out what color I was going to use. Then I chose a reference photograph, filling the canvas with dark shade picked from the reference, made some swatch gradients with other blending tones. The customized brushes were pressure-sensitive and let go off pressure near the bottom. Then I picked the color from mid-tone, generally created a variety of colors of the textures. Then I drew some details such as cracks in a darker color, but did not do the entire length of the cracks in same color or thickness; it would look more natural and harmonious. Considering the lighting angle of the textures, picking the light tone from the reference, making the corners and edges worn, adding scratches, and trying not to make them equally along the length of light scratches. In my experience, the lines vary in thickness will add liveliness figure. The final stage was creating a multiply layer in

Photoshop, in general making some interesting texture and dents, then a lighter color on an overlay layer draw bright faces on the dents; I usually give it a transparency around 50-70 %.

The approach above worked very well for most natural elements textures, especially for rocks, trees, cacti and some sharper edges material. When I draw like desert flower or grass, I applied the same Photoshop techniques but made the contrast and reflection value much lower.

When it comes to tileable textures like sand or rocks, I created all the texture in the middle of the canvas, sometimes duplicating the minor stones or details to accelerate the process, then made it offset twice in Photoshop to make sure it was seamless for procedural shading. I mainly created the tileable textures for rocks and sand; the instances are figures 23 to 25.

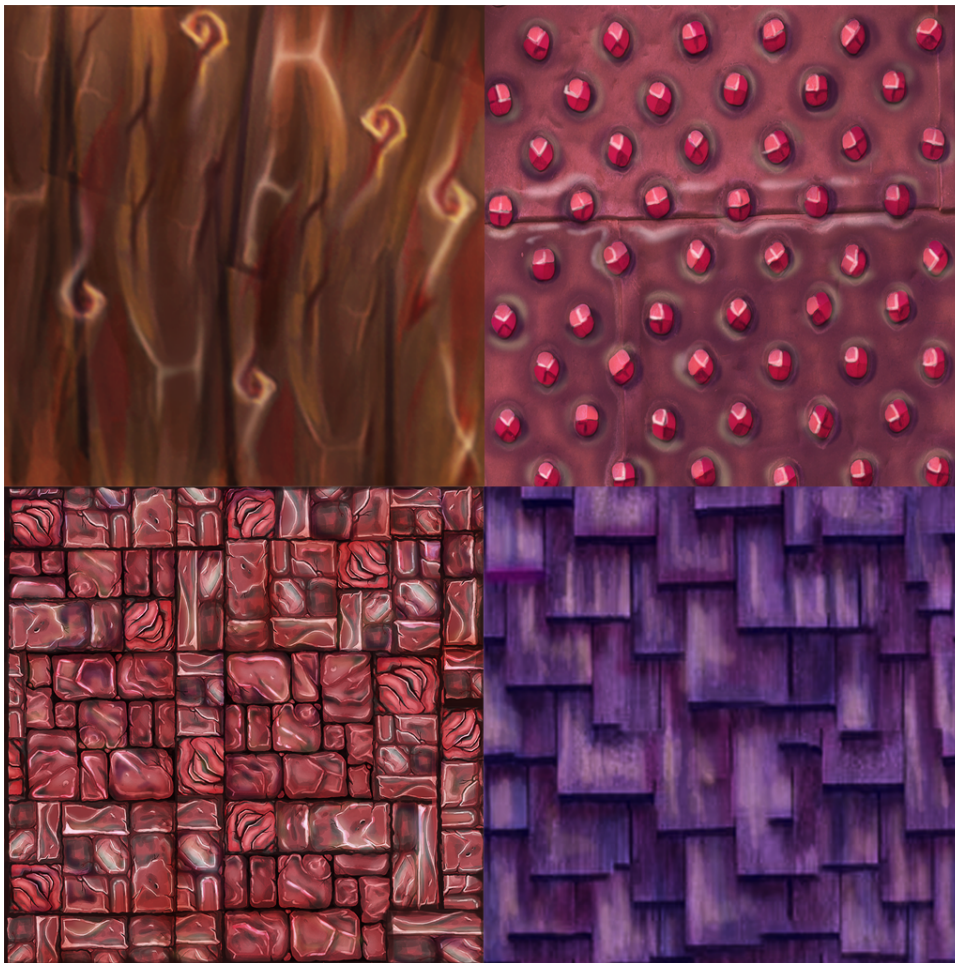


Figure 22: Material study and texturing practices

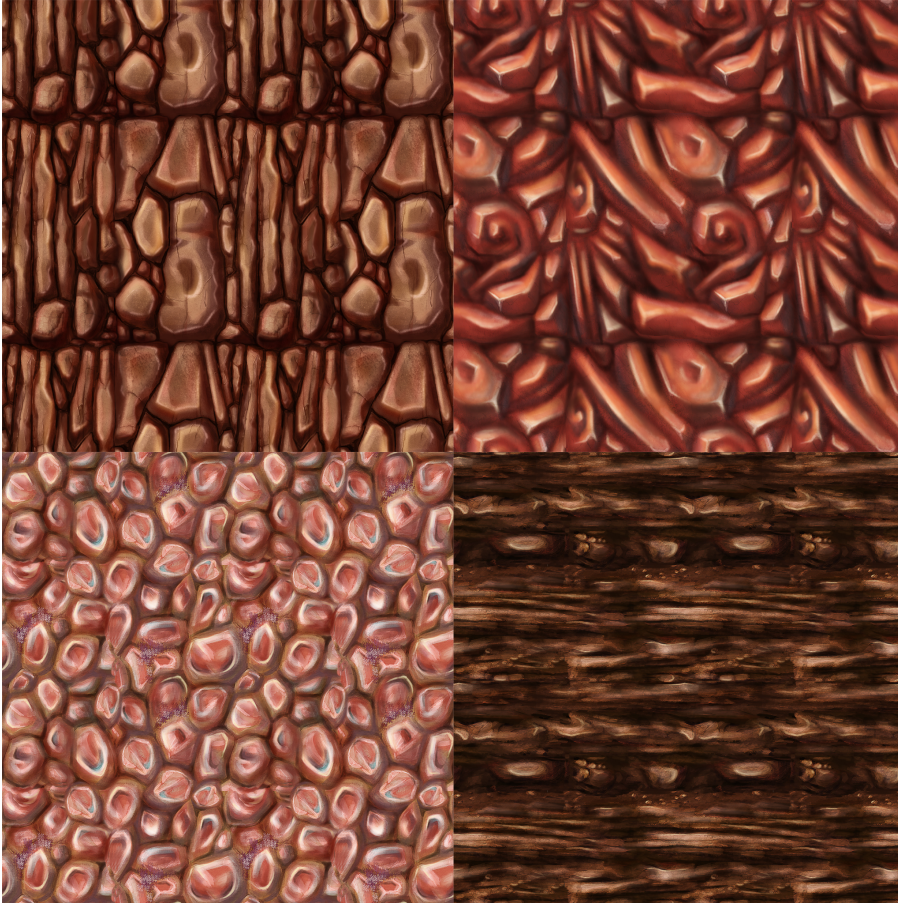


Figure 23: Examples of tileable textures applied in the project

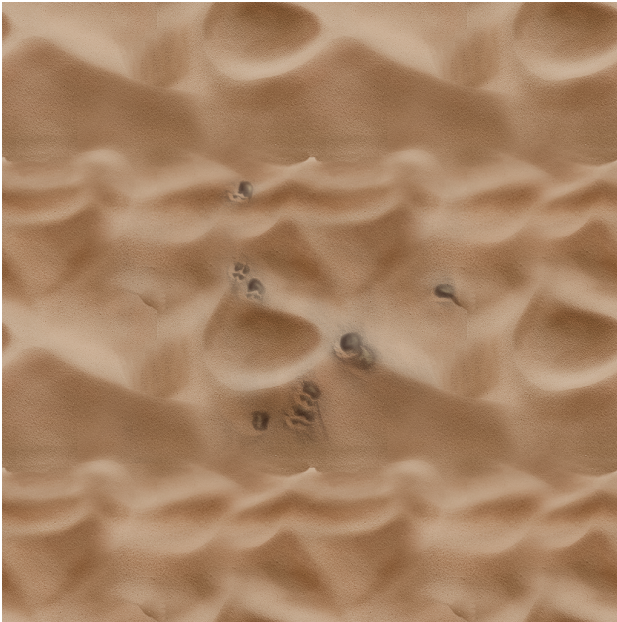


Figure 24: The foxes' footprints on the sand

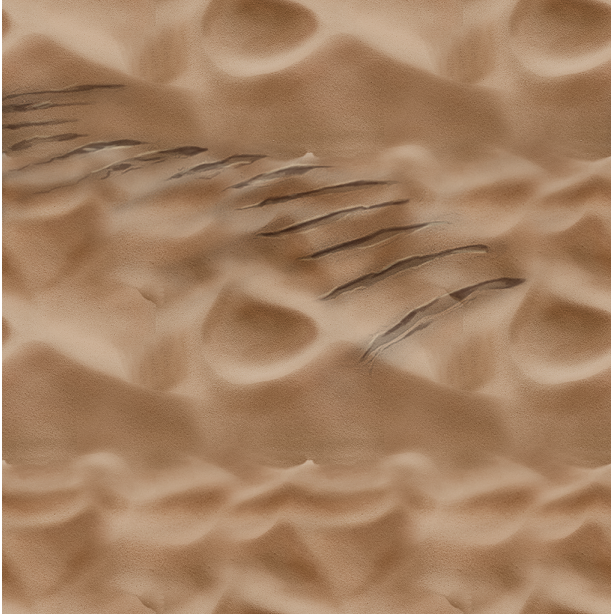


Figure 25: The snakes' footprints on the sand

The UVs unwrapping and efficient use of UVs are very important in game assets creation. Good UVs management will use the most space of texture sheet, keep the most details from the diffuse map and optimize the gameplay to fit most of the device, such as mobile device.

I used two main approaches to optimize my UVs. One was overlapping the UV space if the object had repetitive geometries, like grass, shack's woods, and fences. For instance, the fences' and shack's wood texture, the each single fence shares the same texture space. As figures 26 and 27 show, I tweaked the angle and rotation of the geometries to make it more random and natural.

The other way was creating a rectangle UVs sheet instead of a square one, such as a 2k by 1k map. I unwrapped the UVs in rectangle sheet first, then imported the model with UVs into Maya, selected the whole UVs shell, squeezed it to fit the square space; the last thing was exporting them as 2k by 1k size. As figures 28 and 29 show, the shack's and the lizard's textures were this kind of diffuse maps.



Figure 26: Part of the shack's diffuse map, example of sharing the same UVs space

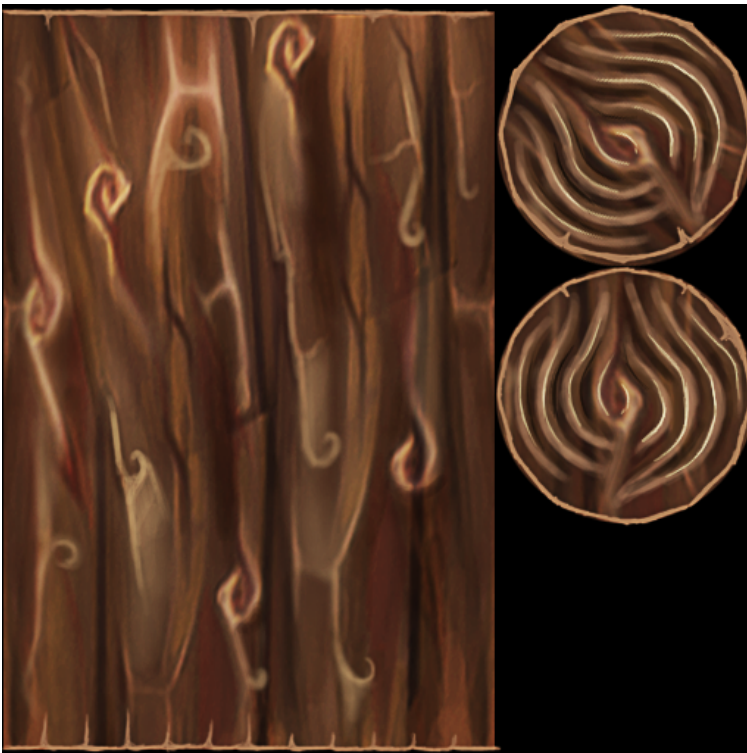


Figure 27: Fences' diffuse map, example of sharing the same UVs space



Figure 28: The texture of the shack, example of rectangle diffuse map

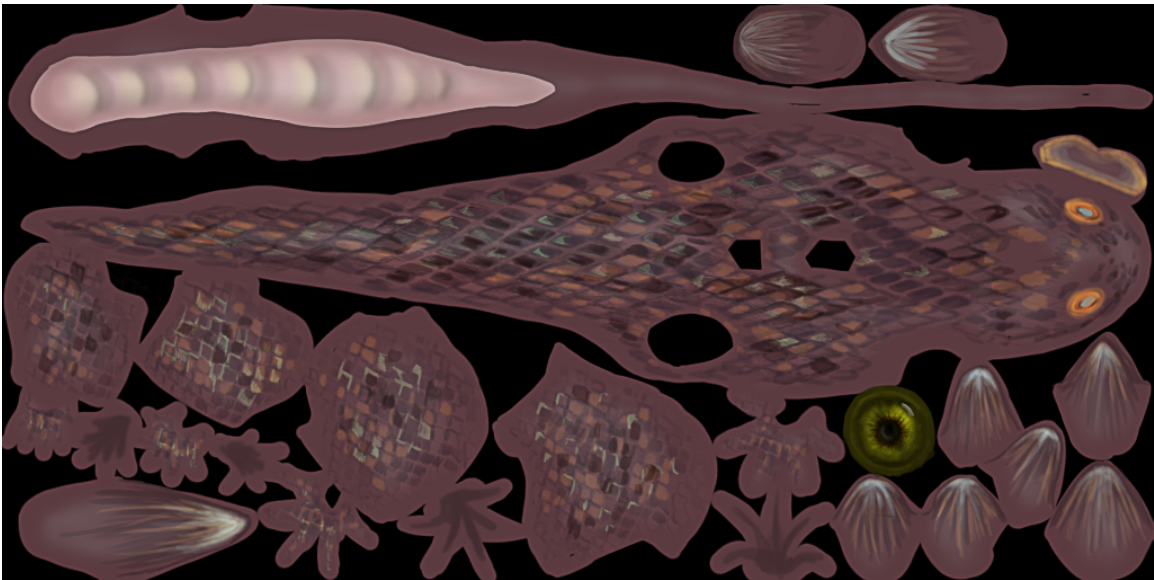


Figure 29: The texture of the lizard, example of rectangle diffuse map

The other approach to saving the poly count was creating a diffuse map with alpha data. This technique is usually applied to the game-ready asset, especially foliage; even just one simple geometry can contain complicated shapes and color information. As figures 30 and 31 show, the examples are my flower and small tree diffuse maps, the black parts of the textures would be cut out.

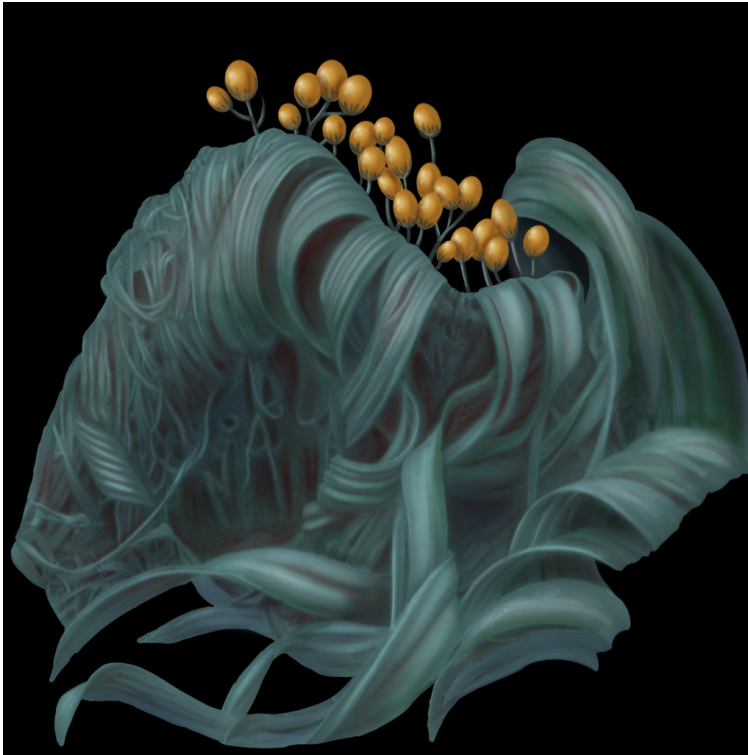


Figure 30: Desert plants, the black part in the alpha channel will be cut out



Figure 31: Desert plants, the black part in the alpha channel will be cut out

Assets Workflow: from Maya to Unreal Engine

There are two main approaches to exporting meshes from Maya to Unreal Engine. With Unreal Engine and Maya on the same system, I can export scenes directly to the Unreal. But personally, I prefer to export the models from Maya separately, it makes it easier to reuse modular assets.

The first thing I did in Maya is setting the grid and axis system. In grid setting, there is length and width; this field is for displaying and setting the length and width of the grid in the perspective view. I usually set the one thousand units in length and width; this controls how large my grid is going to be in perspective viewport; set this to one thousand to start with so that I can always increase or decrease as needed. "Grids lines every" I set to ten units; this controls the grid unit lines as it does in Unreal Engine, so if I set to five, ten or fifty, it will match the unreal engine grid system. The final one is subdivision part; I set to one to match "Grids lines every" value. Then in the preference setting, changed the Axis Z up.

The other thing I set was the pivot point. The pivot point I always located at the origin(0,0,0) and being located at one corner of the mesh to allow proper alignment when snapping the grids.

One important factor is that the meshes in Unreal Engine must be triangulated. I usually model the meshes in quads, but as a game model, triangle meshes are usually acceptable. Before I exported from Maya, I triangulated the meshes in Maya, allowed the clean-up and modification in Maya to make sure all the geometries are clean.

Before I imported the FBX static meshes from Maya, I always checked the Unreal Engine's "Measuring Tool Units" was set to centimeters. From there on, everything in Maya then imported to Unreal Engine matched the same scale across both software

Layout of Game Assets

The video game graphics is real-time rendering. It is one of the interactive areas of computer graphics; it means creating synthetic images fast enough on the computer so that the viewer can interact with the virtual world. Of the many graphical sophistications that have been common parts of next-gen video game design. It is fair to say the quality of real-time assets' quality is much closer to pre-rendered assets, typically movies than before.

However, the variety of games' platforms makes create quality game art challenging. In a console-game environment for Unreal Engine, it recommends using around thirty thousand poly-count for characters, and a game weapon is around ten thousand. But the restrictions of poly-count in mobile devices, such as phones and tablets are more strict; like a mature tree's poly-count should be around one thousand and five hundred. Overall, the restriction of poly-counts depends on the environment size, the numbers of characters, types of shaders and the using of post processing effects.

Controlling the number of poly-count is very important in game art than cinematic art. People who are working on games have to deal with low-poly-count versus details problem. Since they have to achieve maximum details from using minimum poly-count, it is a big deal. In another hand, cinematics artist is having much more freedom than a game artist.

The typical workflow I create game asset is creating a base mesh in Maya, then making high-poly sculpt in ZBrush, retopologizing the mesh into a low-poly model. Unwrapping the low-poly model, baking details of high-poly on the low-poly model. The last stage is texturing, rendering and post process. The different of the cinematic model is that the low-poly model is not necessary.

My thesis assets' workflow was only creating a low-poly model, and generating all the details by texturing in Photoshop. For stylized assets, the high-poly stage is optional because other maps may be unnecessary, such as roughness map.

Shaders Creation and Post Processing

During the process of thesis project production, I have learned various software, such as Substance Designer, Substance Painter, and Unreal Engine. The game engine is an essential part of this project, I mostly have learned from Unreal Engine official documents and online courses, such as Digital Tutors, eat 3D, Gnomon Workshop, and Youtube channels.

The online sources gave me a good foundational knowledge of Unreal Engine, like interface, game asset workflow, lighting, shading, etc. The main technical challenge of this project was to create a cartoony, stylized, painting-like environment in real-time, I would like the assets maintained some physical-based-rendering features as well, like reflection, and at the same time looked visually beautiful and well-designed.

During my learning and experimenting, I found the best solution besides hand-painted textures was the extensive use of post process effects, and carefully designed materials to achieve a painting look. I explored various elements that brought this level alive, from 2D painting to game engine technical features.

There are a bunch of material expression nodes available in the Material Editor. I want to introduce the expression nodes I used a lot in my thesis; I refer to the definition of the Unreal Engine for documentation.

- **Fresnel:** Fresnel is a very efficient expression, it needs fewer instructions and a cheap alternative falloff.
- **Scalar Parameter:** It outputs a single float value, such as constant, which can be changed in an instance of the material or on the fly code.
- **Linear Interpolate Expression:** The LinearInterpolate expression blends between two input values based on a third input value used as a mask. This expression can be thought of like a mask to define the transition between two textures, like a layer mask in Photoshop.
- **Constant Expression:** The Constant expression outputs a single float value. It is one of my most commonly used expression and can be connected to any input.

- **Clamp Expression:** The clamp expression takes in value and constrains them to a specified range, defined by a minimum and maximum value.
- **Panner Expression:** The panner expression outputs UV texture coordinates that can be used to create panning, or moving, textures.
- **Vector Parameter Expression:** The VectorParameter expression is identical to the Constant4Vector, except that it is a parameter and can be modified in instances of the material through code. One nicety of the VectorParameter is that its value can be set using the Color Picker.
- **StaticComponentMask Expression:** Static Component Masks can be used to let instances choose which channel of a mask texture to use.

The cacti, lizard, spider, and shack shared the comparatively simple shader. I defined the minimum and maximum roughness value by using vector parameter expression, then blended with linear interpolate expression. The channels I used were diffuse, specular, roughness and normal. As figure 32 shows, I took the tree shader as an example.

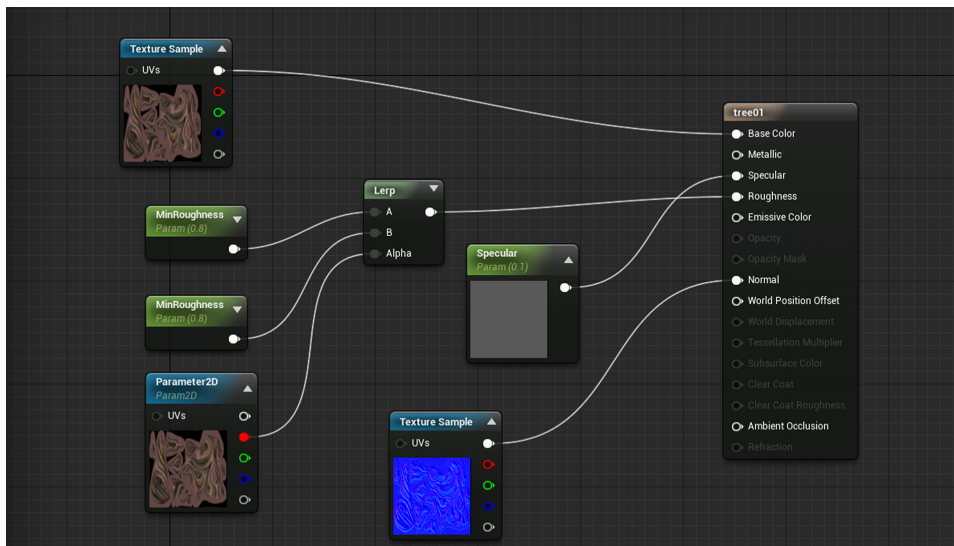


Figure 32: Tree shade

As figures 33 shows, the shader I applied to plants and grass are cut-out shader, the setting was almost the same as tree shader, the only difference was I set the geometry to be double-sided in Unreal Engine, and added transparency channel, which I connected with my alpha map that I exported from Photoshop.

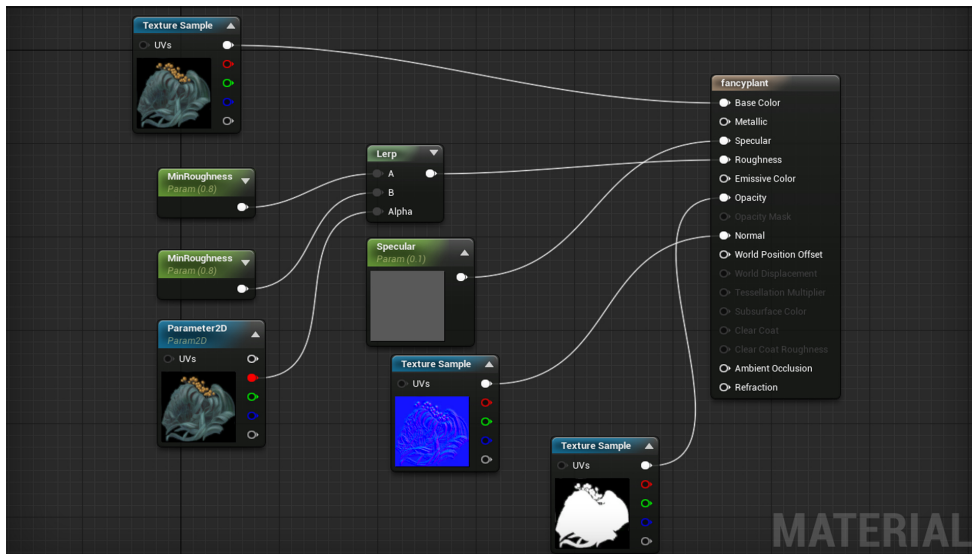


Figure 33: Plant shader

The rock's and aloe's shaders were about emissive color and Fresnel Effect, as figure 34 shows, I applied the Fresnel expression in Unreal Engine, modified the value by several expressions, such as a clamp and linear interpolate expressions. The gamers can see some reflections depend on the viewing angle. The post process effect is handled fully with a Post Process Volume; this Volume contains the post process material.

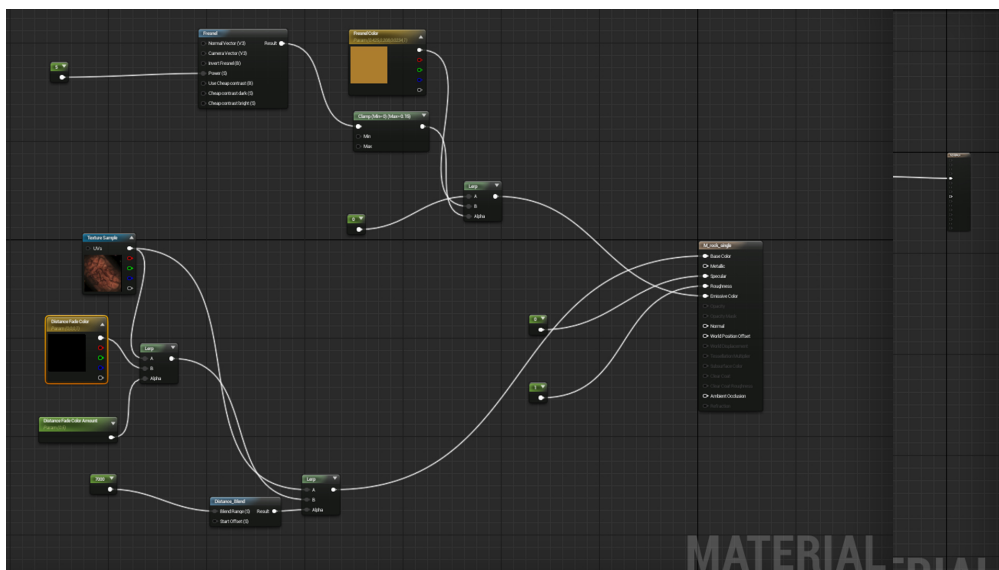


Figure 34: Rock shader

Besides the game assets shaders, the post processing shader was essential to this project, as figure 35 shows, which was used to create the toon-like outline that changes its width by calculating the angle and depth of the camera.

The material was broken up into several sections. I created the outline around the object and connected to the angle and depth sampling. Then I assigned the line width influenced by the camera distance and corrected the overall color of the scene and lines.

To implement this effect, I created a post process material that will add stroke effect for objects that enabled the custom depth rendering, added the material into the blendable list in the post process volume. The last part was for all the static meshes I wanted to have outlines, enable the parameter to make it work.

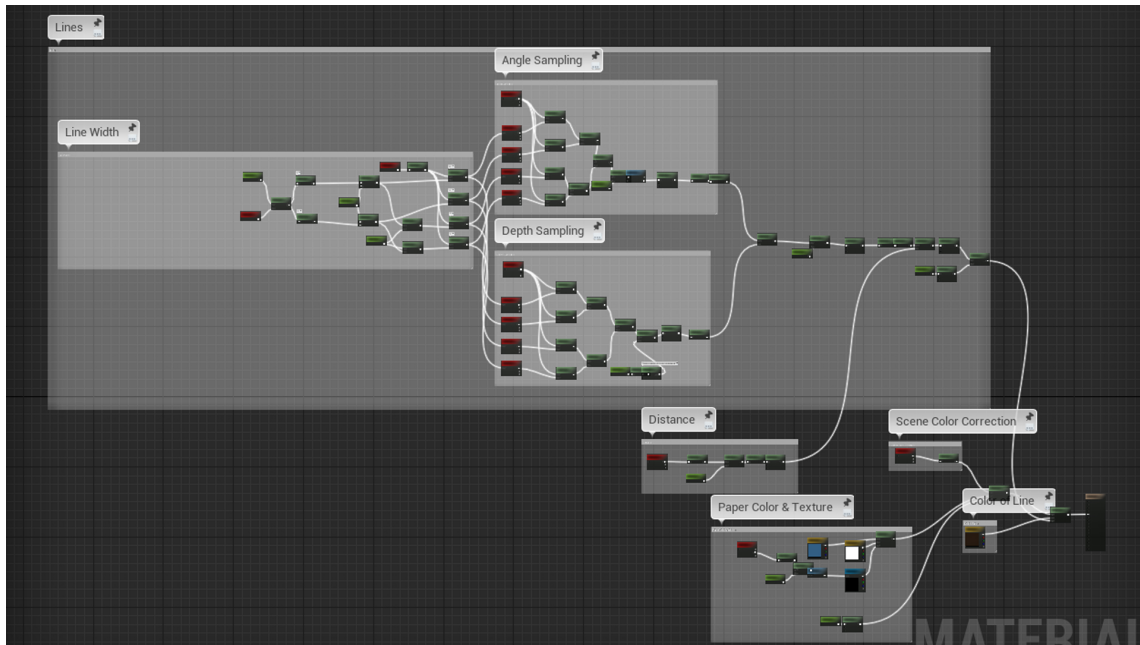


Figure 35: The outline post processing shader

Assets for Desert Game Level

As figures 36 to 61 show, the following is a serial of the static game assets in the projects.



Figure 36: Assets screenshot – aloe 01



Figure 37: Final render screenshot – aloe 02

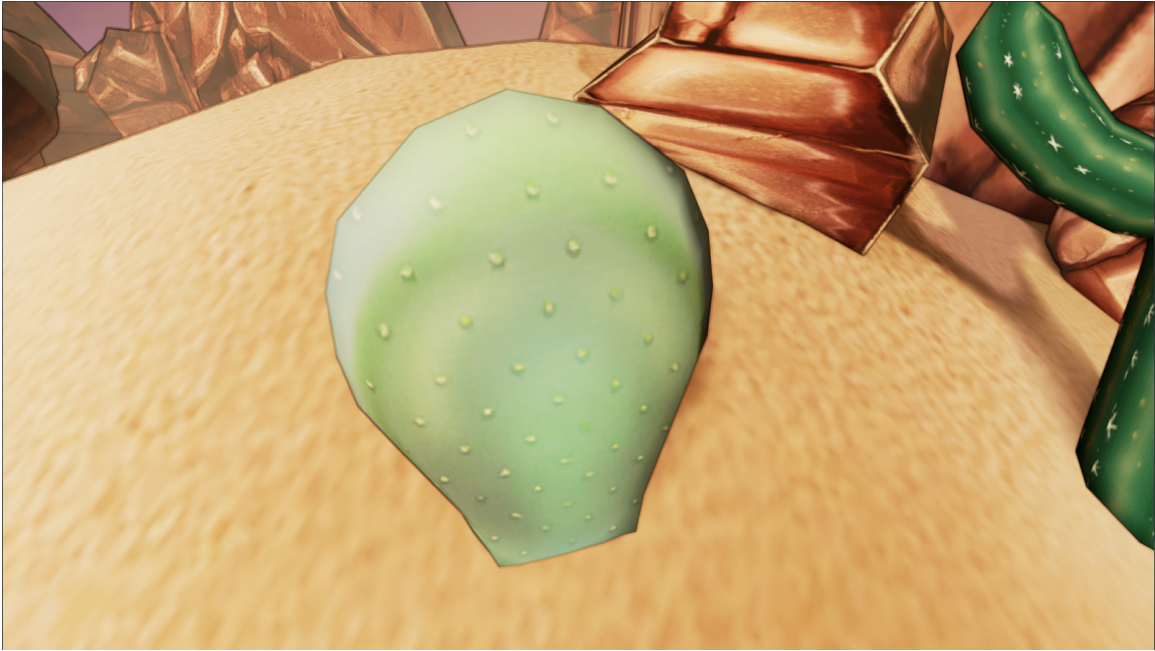


Figure 38: Final render screenshot – aloe 03



Figure 39: Final render screenshot – cactus 01



Figure 40: Final render screenshot – cactus 02

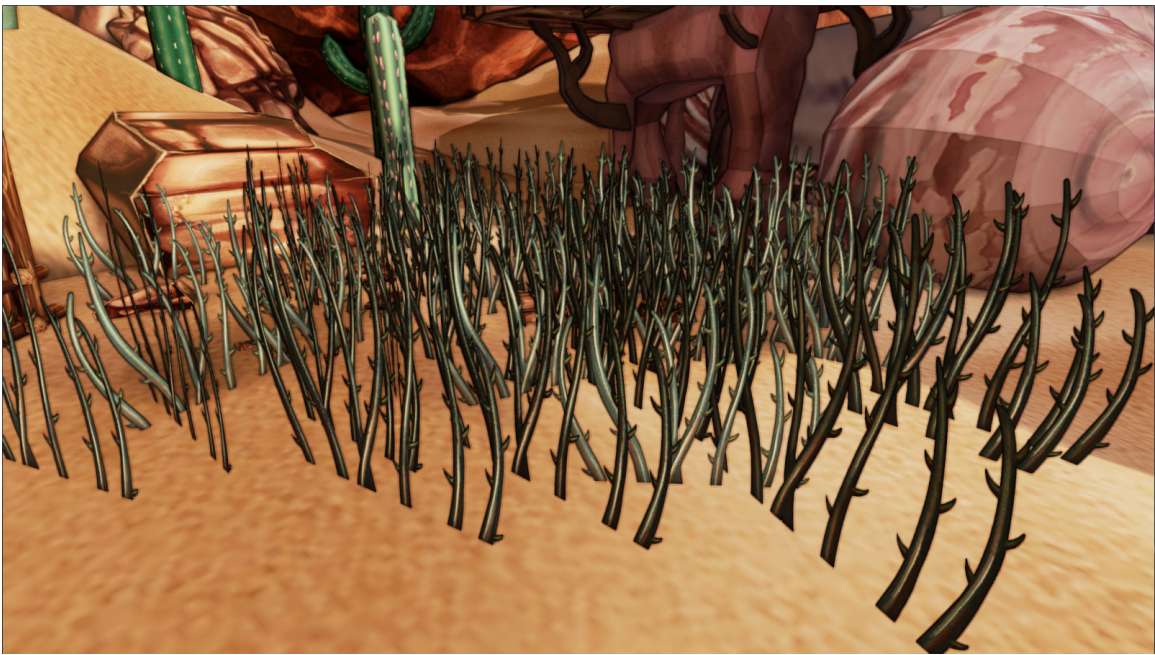


Figure 41: Final render screenshot – grass 01

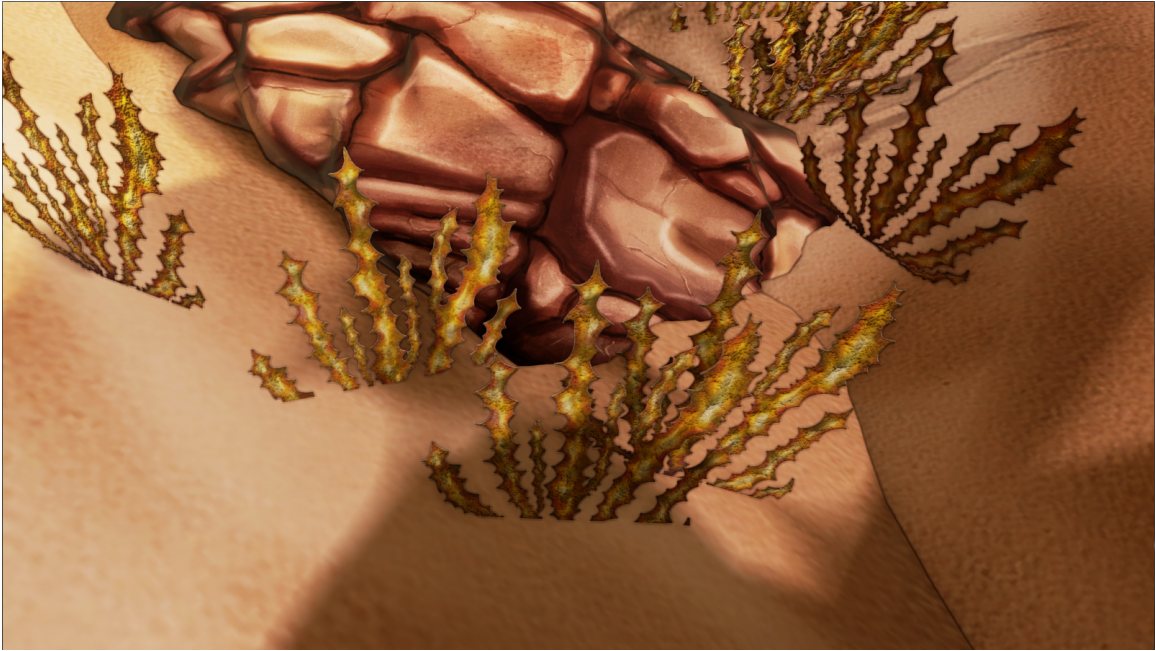


Figure 42: Final render screenshot – grass 02

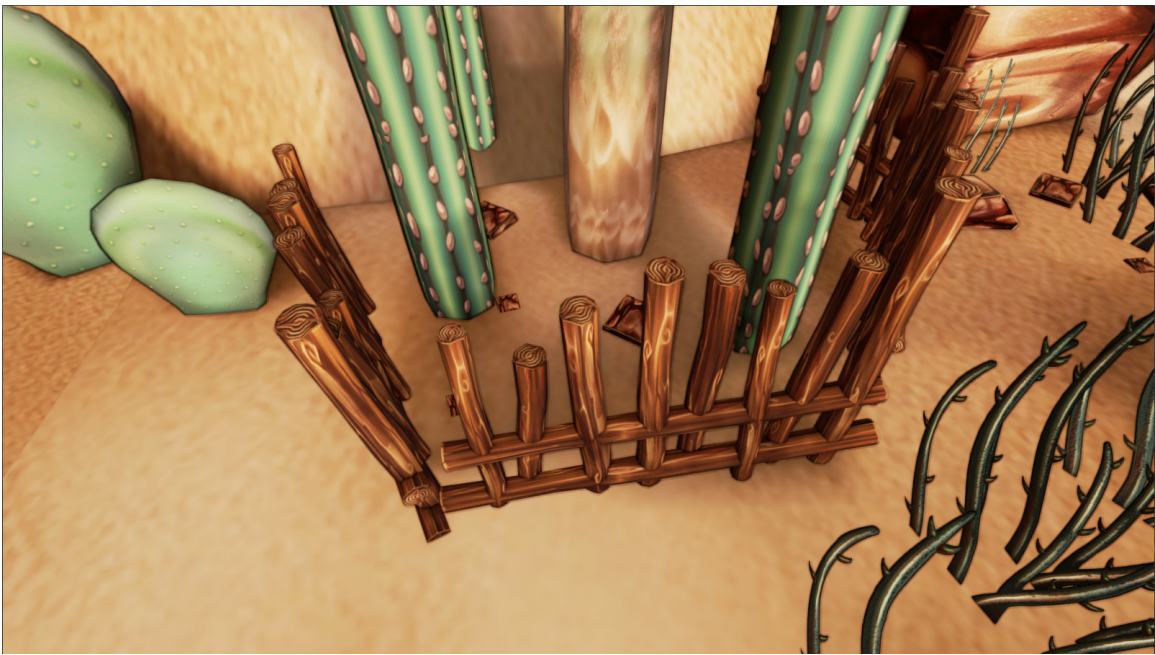


Figure 43: Final render screenshot – fences



Figure 44: Final render screenshot – tree



Figure 45: Final render screenshot – small tree



Figure 46: Final render screenshot – flower 01

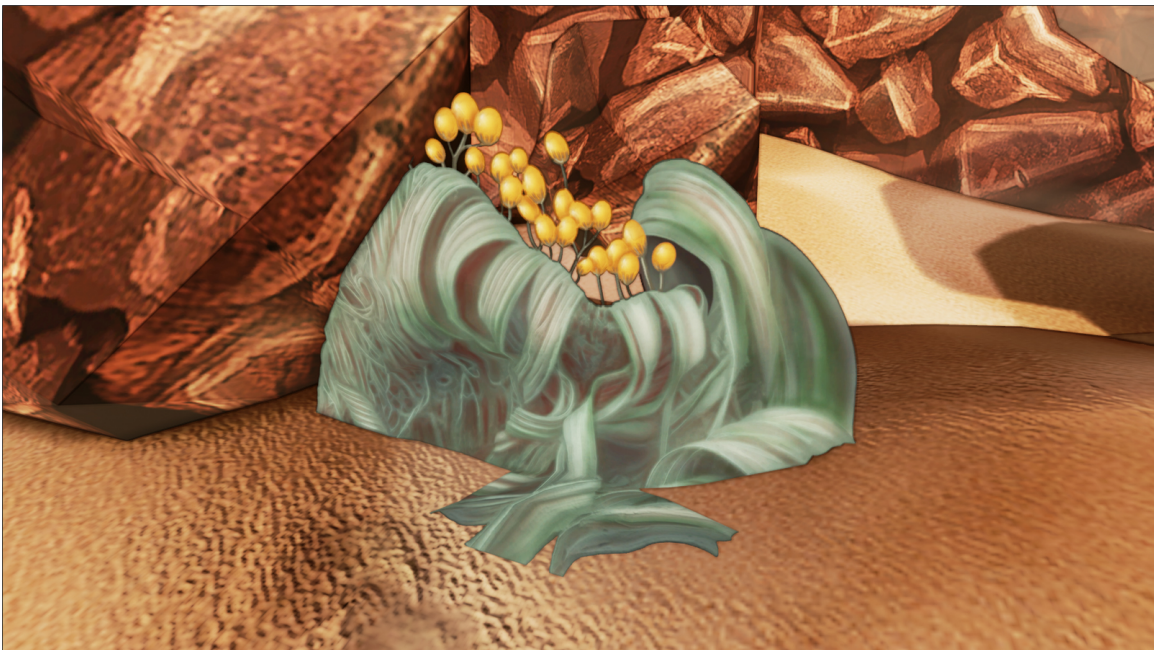


Figure 47: Final render screenshot – flower 02

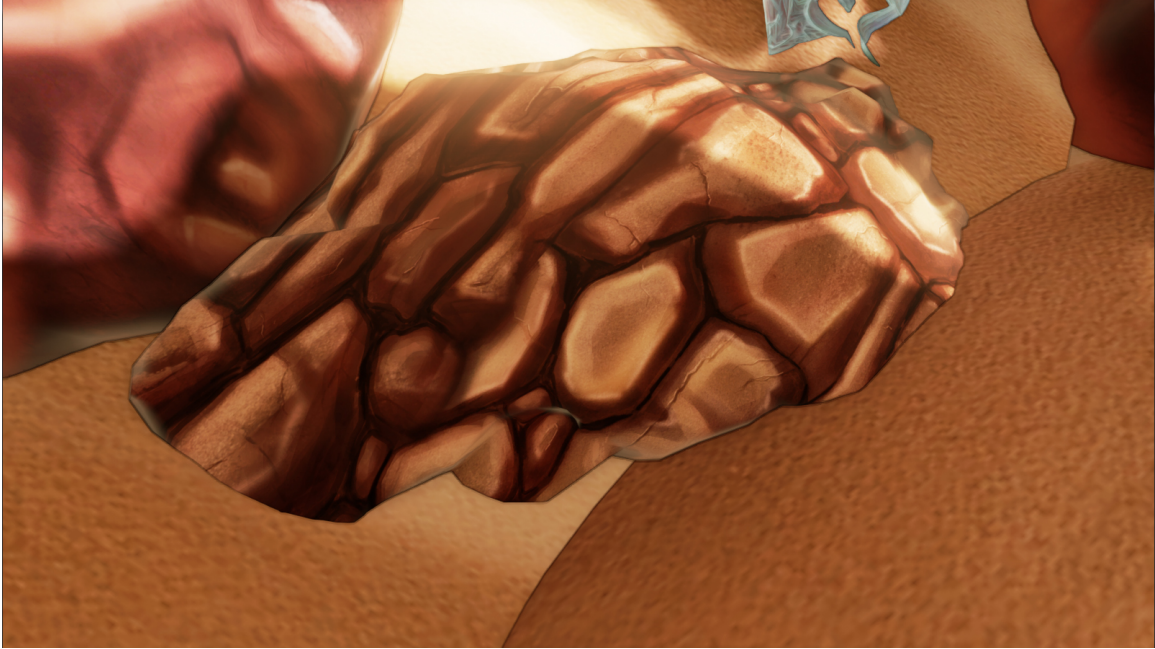


Figure 48: Final render screenshot – rock 01

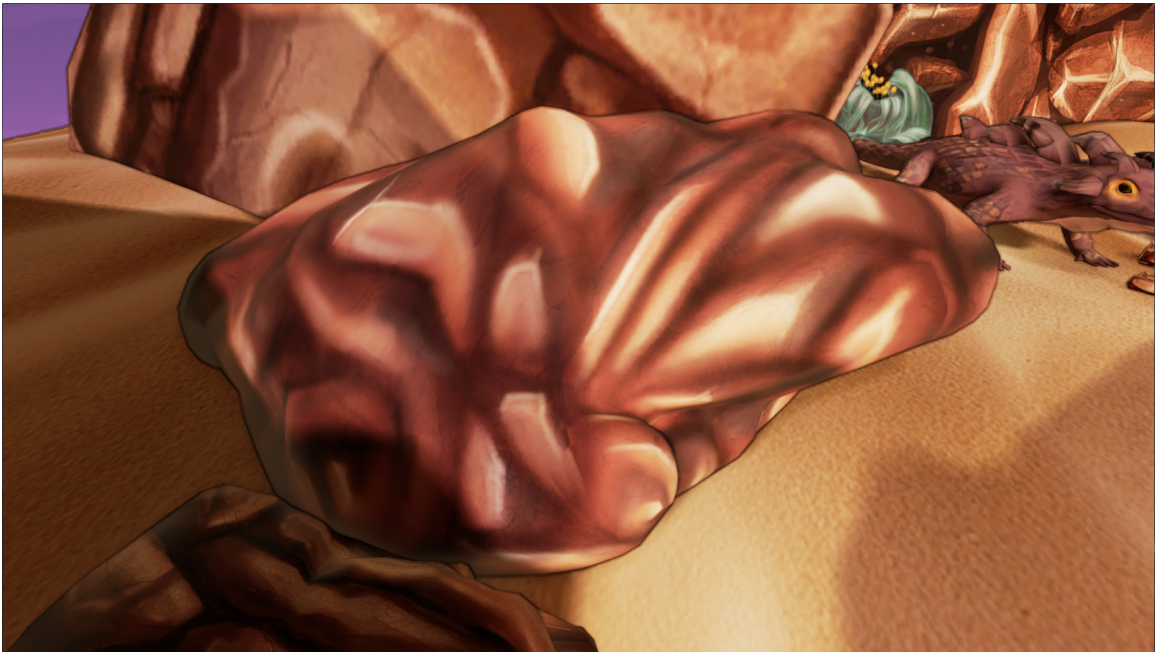


Figure 49: Final render screenshot – rock 02



Figure 50: Final render screenshot – rock 03

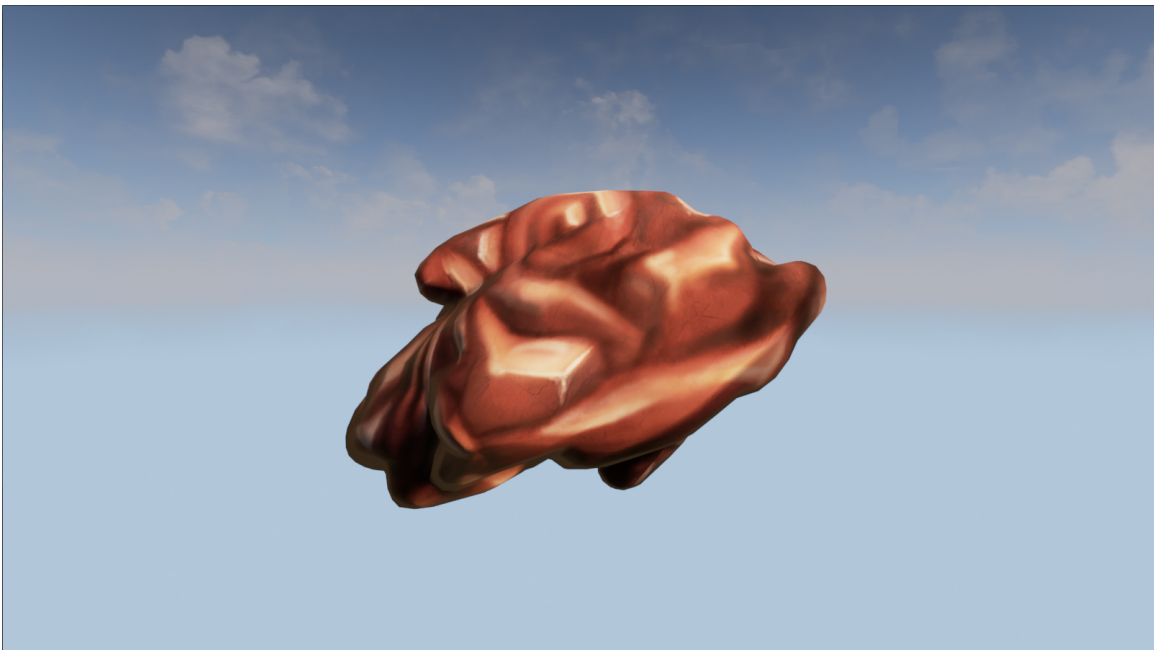


Figure 51: Final render screenshot – rock 04

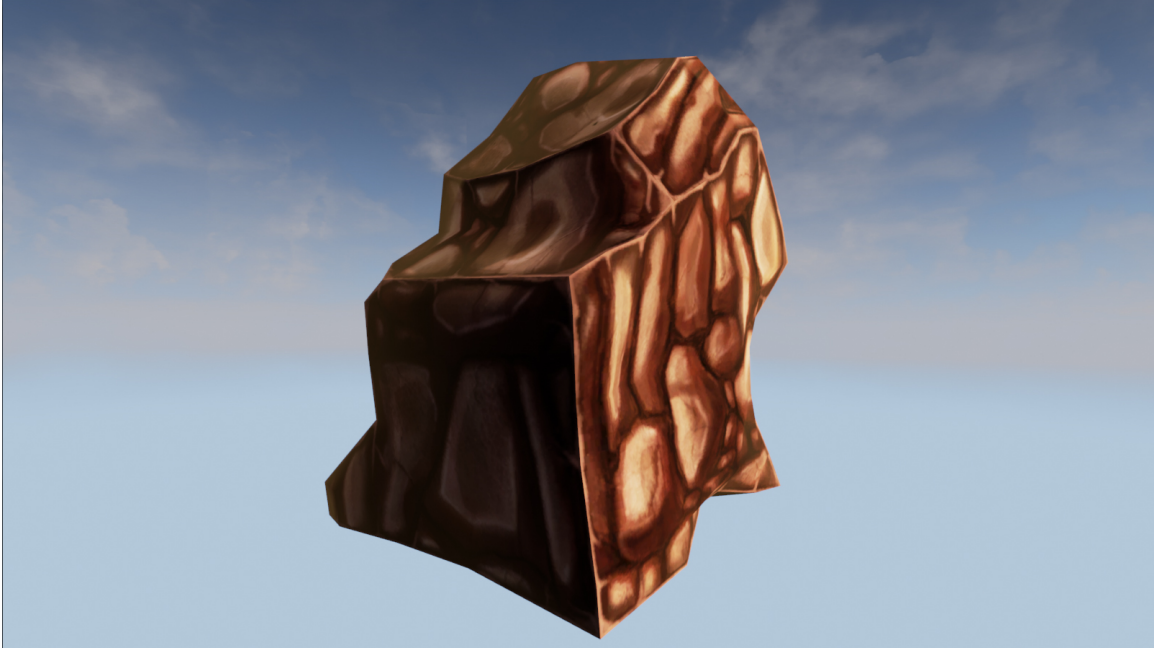


Figure 52: Final render screenshot – rock 05



Figure 53: Final render screenshot – stone

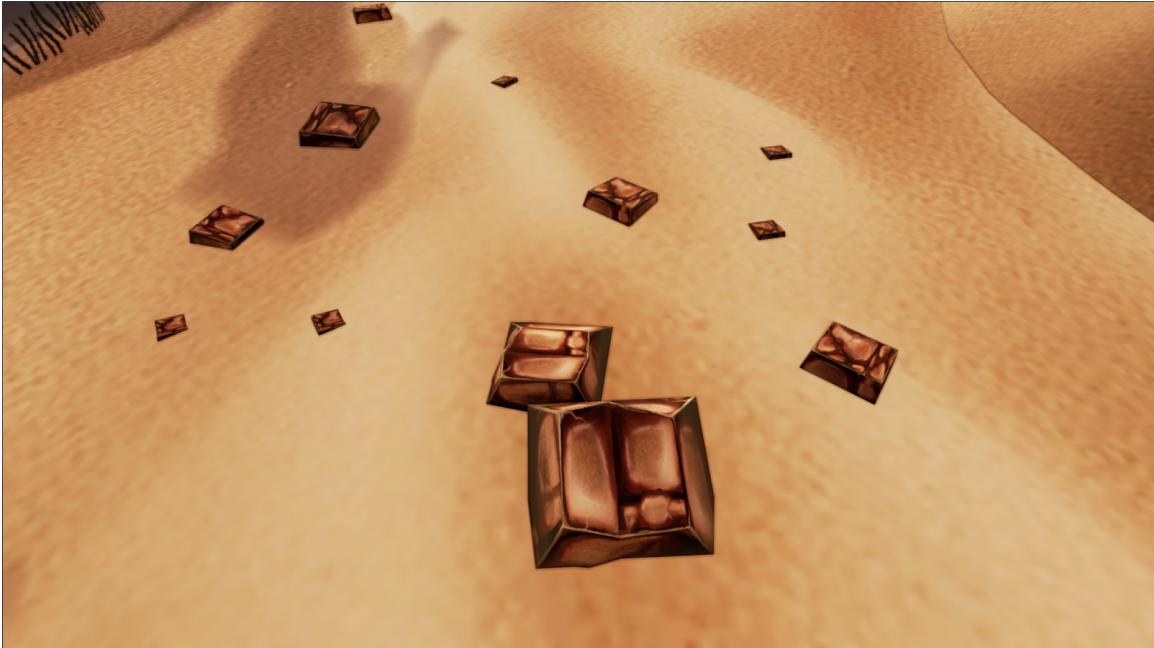


Figure 54: Final render screenshot – small stone



Figure 55: Final render screenshot – house



Figure 56: Final render screenshot – lizard



Figure 57: Final render screenshot – spider



Figure 58: Final render screenshot – plain sand base

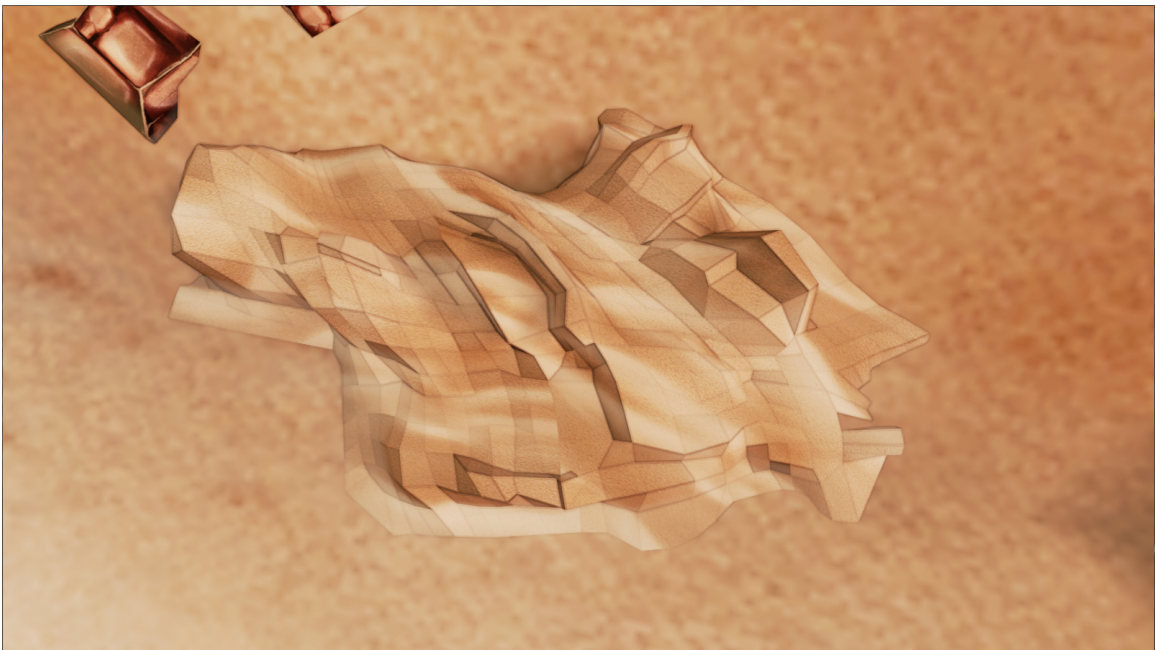


Figure 59: Final render screenshot – plain sand



Figure 60: Final render screenshot – foxes' footprints



Figure 61: Final render screenshot – snakes' tracks

Final Result

As figures 62 to 65 show, the following is a serial of the final results.



Figure 62: Final render screenshot – at noon



Figure 63: Final render screenshot



Figure 64: Final render screenshot



Figure 65: Final render screenshot – early morning

Summary

This project has received much positive feedback. Committee members, classmates, game artists, computer graphics supervisor, and many people who are not in the design or art field have reviewed this project from the early concept stage to the final real time rendering environment. They were impressed by the delicate and well-designed hand-painted textures, and also by the new imagination about survival game with a cartoonish, stylized look.

I hid some visual clues, such as snakes' and foxes' footprints as a survival gaming element. The foxes' footprints can indicate that there are some underground holes around, and the snakes' track can show as a warning sign. They suggested that I could make the footprints more obvious by applying different colors, or adding some particle effects to remind players.

About the visual aspects, my committee members suggest I try the vector painting approach to making the sand and plants blend with each other more, which can make the scene more natural and convincing. And due to the extremely low poly count of the environment, some of the modular rocks showed some unpleasant lines when the players were close.

After refining the project from the critiques I received, the game level looks more promising. I tweaked some of the textures of cacti and lowered the Fresnel effect in the rock shader, and also tried the cell shader to eliminate the post processing lines inside the rocks. I am thankful to have learned so many things in this thesis project and to have experimented with game art in both technical and artistic ways. And the most important part is that in the process of learning, I gave new ideas and influences to the gaming community.

Conclusion

The creation of Oil Painting 3D Scene not only created great technical challenges for me but also the lack of 2D art foundation. I learned from the very beginning and basic foundation of 2D art, the shape, the color, the volume and the perspective. I went through lots of practices, found so many inspirational game artists, and finally shaped my hand-painted art style.

Also, since this was my first big 3D real time project, and I challenge myself to build it up in a new game engine. It is very important for me to reinforce the self-learning, problem-solving and time-management skill. This project is my very start of game art journey and has created a significant meaning to me, and hopefully it will inspire some aspiring artists.

I would like to thank my thesis committee Marla Schweppe, Shaun Foster and Luvon Sheppard for all the advice, guidance and support through the completion of this project. I would like to thank my husband Ebrahim Jarvis for all the kindness and support through the life. I would like to thank my family for their support all the time. And I would like to thank all the friends and game artists who gave me motivation and inspiration. I am thankful for all of you have taken an important role in my art journey.

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Books

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Greenway, Tom., Hargreaves, Jo., Morse, Simon., Perrins, Chris., Tilbury, Richard. Photoshop for 3D Artist, Vol.1. 3DTotal Publishing, 2011.

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3D Artist: Tim Forbrook. "Tim Forbrook." Accessed March 2, 2014. <http://www.forbrook.com/index.html#efEnv>

3D Environment Artist: Jessica Dinh. "Jessica Dinh Gallery." Accessed March 2, 2014. <http://jessicadinh.blogspot.com/>

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Day-Night-Cycle-Game-in-Unreal-Engine

Digital Tutors. "Introduction to Unreal Engine 4." Last modified May 1, 2014. Accessed March 15, 2015

<http://www.digitaltutors.com.ezproxy.rit.edu/tutorial/1609-Introduction-to-Unreal-Engine-4>

Digital Tutors. "Professional Series: Game Asset Production Pipeline." Last modified October 1, 2013. Accessed May 26, 2014. <http://www.digitaltutors.com.ezproxy.rit.edu/tutorial/821-Professional-Series-Game-Asset-Production-Pipeline>

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Senior Artist: Andrew Maximov. "Andrew Maximov." Accessed September 8, 2014. <http://artisaverb.info/>

Unreal Engine 4 Documentation. "Engine Featured Examples: Stylized Rendering." Accessed February 3, 2015. <https://docs.unrealengine.com/latest/INT/Resources/Showcases/Stylized/index.html>

Youtube. "Hand-painted Texture – Stone." Accessed April 4, 2014. <https://www.youtube.com/watch?v=cFovcBlg3nQ>

Appendix

Asset List

Nature:

Aloe 01, Aloe 02, Aloe 03, Cactus 01, Cactus 02, Grass 01, Grass 02, Flower 01, Flower 02, Tree, Small tree, Sand plain, Sand, Foxes' footprints, Snakes' tracks, Rock 01, Rock 02, Rock 03, Rock 04, Rock 05, Stone, Small Stone

Animals:

Lizard, Spider

Architecture:

Shack, Fences

Shader:

Plants shader, Fresnel Effect aloe shader, Fresnel Effect rocks and stone shader, Cut-out shader, Architecture shader, Water shader, Sky dome shader, post-processing toon outline shader

Review of Literature

During the process of this project, I met several technical issues, concept changes and art style experiments. Review of Literature is the capsulation of the importance of what was researched after the acceptance of thesis proposal.

This review of literature includes three sections, the research of the art, 2D hand-drawn practice material and real time 3D technical research.

The Art

1. **Botany for the Artist: An Inspirational Guide to Drawing Plants**

Simblet, Sarah. Botany for the Artist: An Inspirational Guide to Drawing Plants. New York: DK Publishing, 2010

This book is a great reference for plants. The pages contain a mix of photographic plant portraits and detailed sketches. It also includes educational information, every part of the plants are explored, from the roots, stems, leaves, flowers to the fruits. It gave me a lot of inspirations of creating my stylized plants.

2. **Game Art Portfolio Wall**

Game Art Portfolio Wall. "Environment Portfolio" Last modified July 14, 2015. Accessed March 2, 2014. <http://gameartportfoliowall.com/>

This website is a collection of the best game art portfolio around the world; it includes a wide range art style from realistic to stylized environment game art.

3. **Tim Forbrook Portfolio**

3D Artist: Tim Forbrook. "Tim Forbrook." Accessed March 2, 2014. <http://www.forbrook.com/index.html#efEnv>

Tim Forbrook is currently a 3D artist at Escalation Studios; he specializes in characters, creatures, and environment props creation. His works are a combination of stylized textures and physical based shaders.

4. **Jessica Dinh Portfolio**

3D Environment Artist: Jessica Dinh. "Jessica Dinh Gallery." Accessed March 2, 2014. <http://jessicadinh.blogspot.com/>

Jessica is currently an associate 3D artist at Blizzard Entertainment. Her works are extremely low poly count and detail-oriented. The way she collected photo references and created foliage is very inspirational.

5. **Andrew Maximov Portfolio**

Senior Artist: Andrew Maximov. "Andrew Maximov." Accessed September 8, 2014. <http://artisaverb.info/>

Andrew Maximov is currently a 3D artist at Naughty Dog. He specializes in game environment and production pipeline. His works include cartoon and realistic stylizes, and different ways how to make game art runs more efficient in the game engine.

6. **Antonio Neves Artstation Page**

Artstation. "Artstation: Antonio Maximov Page." Last modified October 25, 2015. Accessed March 14, 2015. www.artstation.com/artist/antonioneves

Antonio Neves is a freelance game artist. He specializes in hand-painted environment game art creation. His art is very inspirational; he also teaches how to paint the props in a proper view, how to add some vertexes in the termination of the meshes to create the silhouette.

The 2D Hand-drawn Practice

1. **Beginner's Guide to Digital Painting in Photoshop**

Aleksander, Nikolai. Beginner's Guide to Digital Painting in Photoshop. 3D total publishing, 2011.

This book is a series dedicated to providing a comprehensive guide to the basics of digital painting in this versatile program. It offers a lot of different approaches and advice to get you started, improve workflows and drawing techniques.

2. **Drawing Lab for Mix-media Artist: 52 Creative Exercises to Make Drawing Fun**

Carla, Sonheim. Drawing Lab for Mix-media Artist: 52 Creative Exercises to Make Drawing Fun. Quarry Books, 2010.

This book offers a fun way to learn and gain expertise of drawing through

experiment and play. This book gives me a good suggestion how to enjoy 2D painting practices and gain new skills and confidences.

3. Hand-painted Texture – Stone

Youtube. “Hand-painted Texture – Stone.” Accessed April 4, 2014.
<https://www.youtube.com/watch?v=cFovcBlg3nQ>

This tutorial is by Nikolay Dynakov, teaching steps of hand-painted textures ideas and techniques.

3D Technical Researches

1. Photoshop for 3D Artist

Greenway, Tom., Hargreaves, Jo., Morse, Simon., Perrins, Chris., Tilbury, Richard. Photoshop for 3D Artist, Vol.1. 3DTotal Publishing, 2011.

This book is intended to show how 2D techniques can be seamlessly blended into the 3D production pipeline. It covers different subjects about texturing, from the initial concept stage to post-production.

2. Creating a Stylized Set Element for Games in Maya

Digital Tutors. “Creating a Stylized Set Element for Games in Maya.” Last modified December 9, 2013. Accessed March 2, 2014.
<http://www.digitaltutors.com.ezproxy.rit.edu/tutorial/1420-Creating-a-Stylized-Set-Element-for-Games-in-Maya>

This tutorial is by Stanislav Poritskiy. It covers the entire process of creating a stylized game assets and focus on topic involves low-poly modeling, UV-layout, and proper UV-sizing. Then use Marmoset Toolbag to visualize quickly the texture on the model, check lighting, reflections, specular and other maps. And teaching how to use a photo-textures that we would sample for color and generate masks to fill and produce a unique texture as a result.

3. Professional Series: Game Asset Production Pipeline

Digital Tutors. “Professional Series: Game Asset Production Pipeline.” Last modified October 1, 2013. Accessed May 26, 2014.
<http://www.digitaltutors.com.ezproxy.rit.edu/tutorial/821-Professional-Series-Game-Asset-Production-Pipeline>

This tutorial is by Joshua Kinney. This series is about techniques for creating game-ready assets, from high-poly models to low-poly models. Discussing

how to create a custom brush in ZBrush to increase productivity, and then baking out texture maps to create a good base texture in photoshop.

4. Introduction to Unreal Engine 4

Digital Tutors. "Introduction to Unreal Engine 4." Last modified May 1, 2014. Accessed March 15, 2015

<http://www.digitaltutors.com.ezproxy.rit.edu/tutorial/1609-Introduction-to-Unreal-Engine-4>

This tutorial is by Joshua Kinney. In this tutorial, I have learned all the basics of Unreal Engine 4. Exploring the interface, materials, lighting, and finalizing the visuals.

5. Buiding an Interactive Day Night Cycle Game in Unreal Engine

Digital Tutors. "Buiding an Interactive Day Night Cycle Game in Unreal Engine." Last modified February 20, 2015. Accessed May 10, 2015.

<http://www.digitaltutors.com.ezproxy.rit.edu/tutorial/1995-Building-an-Interactive-Day-Night-Cycle-Game-in-Unreal-Engine>

This tutorial is by Shaun Foster. I have learned how to build a day-night cycle and customized the sky dome comes with the Unreal Engine, and how to set up the camera.

6. Stylized Rendering

Unreal Engine 4 Documentation. "Engine Featured Examples: Stylized Rendering." Accessed February 3, 2015.

<https://docs.unrealengine.com/latest/INT/Resources/Showcases/Stylized/index.html>

This showcase demonstrates the creation of a stylized, cartoony, type of environment for a game. The level makes extensive use of post process effects, landscape tools, and carefully designed materials to achieve a hand-painted effect. I took as a reference how the material, rendering, and skydome shader work.

Thesis Proposal

Oil Painting 3D Scene:

A Desert Survival Game Environment

Chien-Hui Liao

Thesis Proposal for the Master of Fine Arts Degree Rochester Institute of
Technology CIAS, School of Design

Visual Communication Design

Thesis Proposal

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Visual Communication Design

Title: Oil Painting 3D Scene: A Desert Survival Game Environment

Submitted by: Chien-Hui, Liao

Date: October 21, 2013

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Date

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Date

Abstract

Keywords: survival game, desert, hand-painted texture

I propose to create a game level environment of a desert. I will create a survival and adventure game in a desert environment with a new art style— an oil painting technique applied to a 3D scene. My thesis will focus only on visual aspect, the interaction will be shown in short video clips with camera movements through the scene. Programming of the user interface is not a component of the project. The focus is on the visual elements of the desert environment.

Developing several concept art, including a ground and an underground world, a 2D map of the space and concepts for plants and animals is the first step in this project. Then I will create the concept of props, the animals and plants in the scene, and then focus on experimenting with the hand-painted textures. I will make the environment for four different times of a day: early morning, noon, late evening and midnight. Distinct times will have different animals, plants and several ways to survive in the scene.

Problem Statement

The use of desert environment has become a commonplace in the world of games. Most of them are shooting or action games with very similar art styles. But per my survey, I find four different interesting art styles of game environments. Take Uncharted, World of Warcraft and Okami for instance. Uncharted has a realistic desert scene while World of Warcraft has two desert environments. Uncharted uses photo-realistic textures to build the scene, while World of Warcraft's environments have bright colors, and a cartoon-art-style with hand-painted textures. Journey intends to make the player feel "small" and to give them a sense of awe about their surroundings. The art style with purity of forms is at odds with most contemporary games. In the "Japanese garden", they removed all of the game elements that do not fit with the others, so the emotions they wanted the game to evoke would come through. Okami features a distinct traditional ink visual style to perform miracles in a woodcut, watercolor or environment, which looks like an animated Japanese ink-illustration. These games provide me with a lot of inspiration for my thesis proposal. In conclusion, I will create a desert environment with hand-painted textures. It is a 3D environment; it will look like an oil painting, but gamers can explore in the scenes as a 3D-based game.

The interaction potential of my environment is based on game theory. In game theory, "a game is a decision-making situation with interdependent behavior between one or more individuals" (Harris, 1999). "The individuals involved in making the decisions are the players. The set of possible choices made by the players are strategies. The outcomes of the choices and strategies played are the payoffs. Payoffs are often stated as levels of utility, income, profits, or some other objective particular to the game. A general assumption in game theory is that players seek the highest payoff attainable. (Nicholson, 2002)." As per my review of existing games, the "payoff" in most of the games is the "typical defeat/ kill/win" mentality of most video games. I hope in my thesis, my idea will go beyond. I will create my desert scene as a survival game, gamers can explore with my painting art style and search the hints and clues in the environment to survive. I think it will be both interesting and educational, and create a new gaming experience comparing to other games.

Review of Literature

In the literature review, I selected books related to game design, game art, and game concept drawing. I also reviewed several online articles, these and websites about game environment and concept art.

Books

Basic Drawing for games

Pardew, Les. *Basic Drawing for games..* Massachusetts: Tomson Course Technology, 2006.

This book is about drawing. It covers many basic drawing principles, but also drawing as it relates to game development. It contains specific elements of drawing for games, like environmental design, character design, storyboarding and animation. It helps me to become familiar with drawing for game development and to provide solid information on creating good drawing.

Drawing Basics and Video Game Art

Solarski, Chris. *Drawing Basics and Video Game Art.* New York: Watson-Guption Publications, 2012

The focus of this book is how far we can push the world of game art in purely visual terms without relying on the technology of interaction, that is, on sound, special effects, and animation. I discovered how visual grammar can be artistically shaped to create a range of emotional experience using classical theory of depth, composition, gravity, movement, and artistic anatomy.

Designing Virtual Worlds

Bartle, Richard A. *Designing Virtual Worlds.* California: New Riders Publishing, 2004.

Chapter four of this book is really helpful. It discusses about how to design a virtual world. Generally, it includes business, technical, gameplay, genre, platform

and unique selling points. The most important thing about designing a virtual world is all about “players”. I need to create a world to fit them. The more I know about them, the better I will be about to create a great virtual world.

Game Art: Creation, Direction, and Careers

Linde, Riccard. *Game Art: Creation, Direction, and Career*. Massachusetts: Charles River Media, 2005.

This book for me is a tool to explore the principles of game creation. It also has explanations of game design workflow, from an idea to a game; from preproduction to production. It provides useful recourse for me to apply those principals to my thesis design.

Game Design: From Blue Sky to Green Light

Tod, Deborah. *Game Design: From Blue Sky to Green Light*. Massachusetts: Wellesley, 2007.

This book aims to analyze a game. If games are going to be a true dominant art form in this century, we have to elevate them beyond the simple mechanics of the gameplay or the graphics. A good game has different aspects, including storytelling, visual style, character rules, environments, puzzles and levels. All that matters is actually the experience. I want to create a game environment with new gaming experience and new visual style.

Game Design: Principles, Practice, and Techniques—the ultimate guide for the aspiring game designer.

Jim, Thompson. *Game Design: Principles, Practice, and Techniques—the ultimate guide for the aspiring game designer*. New Jersey: John Wiley & Sons Inc., 2007.

This book includes three main parts: contents, design process and design production. It introduces several types of gameplay, such as first-person shooter, platform games, strategy games and survival games. Then it explains how to gather inspirations and design the whole games. It also provides a lot of examples of classic games of different genre.

Photoshop for 3D artist, V1:Enhace your 3D renders! Previz, Texturing and Post Production

Greenway, Tom., Hargreaves, Jo., Perrins, Chris., Morse Simon., Tibury, Richard. *Photoshop for 3D artist, V1: Enhance your 3D renders! Previz, Texturing and Post Production*. United Kingdom: 3DTotal Publishing, 2011.

Photoshop is essential in 3D texturing. My thesis is about hand-painted texturing and it provides an overview of how Photoshop can be implied in the CG field. It helps me to texture my environments, characters and props with almost every tweaking and compositing passes in Photoshop to some degree.

Prime: The Definitive Digital Art Collection—Scenes

Alvarez, Alex., Andree Wallin., Stefancik, Andrej., Skykut, Andrzej., Eftekhari, Antony., Lammarino, Anthony., Olschinsky, Atelier., Qingfeng, Chen., Dammrich, Conelius., Martin, Damir G., Ghiordanescu, Dan., Tolkishevsky, Denis., Mitsuk, Dmitry., Mitsuk, Dmitry., Mykolaitis, Edgaras., Brodau, Erasmus., Corvino, Francesco., Baranger, Francois., Jarrys, German., Alqiang, Hao., Karaaslan, Hasan., Monteiro, Jacinto., Swanepoel, Jaco., Strehle, James W., Vollmer, Jan K., Moore, Jeremy A., Wlodarczyk, Karol., Denis, Lebedev., Jakubowski, Marcin., Denko, Marek., Lovadina, Markus., Gutierrez, Miguel A., Najafi, Morteza., Vernay-Kim, Olivier., Saliba, Rafael R., Zancanaro, Ramon., Yang, Raymond., Tibury, Richard., Weaner, Simon., Scholes, Thomas., Jones, Tim., Bratincevic, Toni., Korpi, Tuomas., Zehtabi, Vahid., Fretyan, Vikter., Konstantinov, Vlad., Gagic, Vukasin., Mazurkin, Yuriy. *Prime: The Definitive Digital Art Collection—Scenes*. United Kingdom: 3D Total Publishing: 2012.

This is a collection of concept examples: Sci-fi, cartoons, fantasy and scenes. It displays different styles and storytelling in various environments. I think they are great sources of inspiration.

Thesis

An Introduction to Game Theory: Application in Environmental Economics and Public Choice with Mathematical Appendix

Bogard, Matt. *An Introduction to Game Theory: Applications in Environmental Economics and Public Choice with Mathematical Appendix*. Master diss., Western Kentucky University, 2012

This thesis is about “game theory”. Game theory is a mathematical technique developed to study choice under conditions of strategic interaction. And this thesis gives me an idea how to put some hints and puzzles in my game environment.

Concept Art World

Concept Art World. “*Aaron Miller*.” Last modified October 19, 2013. Accessed October 10, 2013. <http://conceptartworld.com/?p=28019> One of the best concept art websites I have ever found. A lot of awesome works are posted here. It also includes several books and training tutorials.

Discovery News: Desert Survival—8 Simple Tips That Could Save Your Life

Discovery News. “*Desert Survival—8 Simple Tips That Could Save Your Life*” Last modified September 26, 2011. Accessed October 12, 2013. <http://news.discovery.com/adventure/survival/desert-survival-8-simple-tips-that-could-save-your-life.htm>

It provides essential information about how to survive in a desert environment. It gives me much inspiration how to set puzzles in my environment.

The game environment from an auditive perspective

Analysis of game environment. Last modified September 25, 2013. “*The game environment from an auditive perspective*.” Accessed October 3, 2013.

t of this article is description about the distinction between user and game environment. It explores the player’s spatial experience and explains the game environment is usually generated by very consistent elements that will not vary from player to player. As most games are packaged as a product in a specific form on a storage device the distribution of the same data to all the players is ensured. It gives me a overall idea what should consider in a game environment.

WikiHow: How to Make Water in the Desert

WikiHow. “*How to Make Water in the Desert*” Last modified September 15, 2013. Accessed October 2, 2013. <http://www.wikihow.com/Make-Water-in-the-Desert> All about how to find water in a desert, giving me much inspiration how to set puzzles in my environment.

Website

Desert USA: Dessert Animals

Desert USA. "*Desert Animals*" Last modified October 4, 2013. Accessed October 4, 2013. <http://www.desertusa.com/animals.html>A collection of desert animals: reptiles, mammals, birds, fish and amphibians.

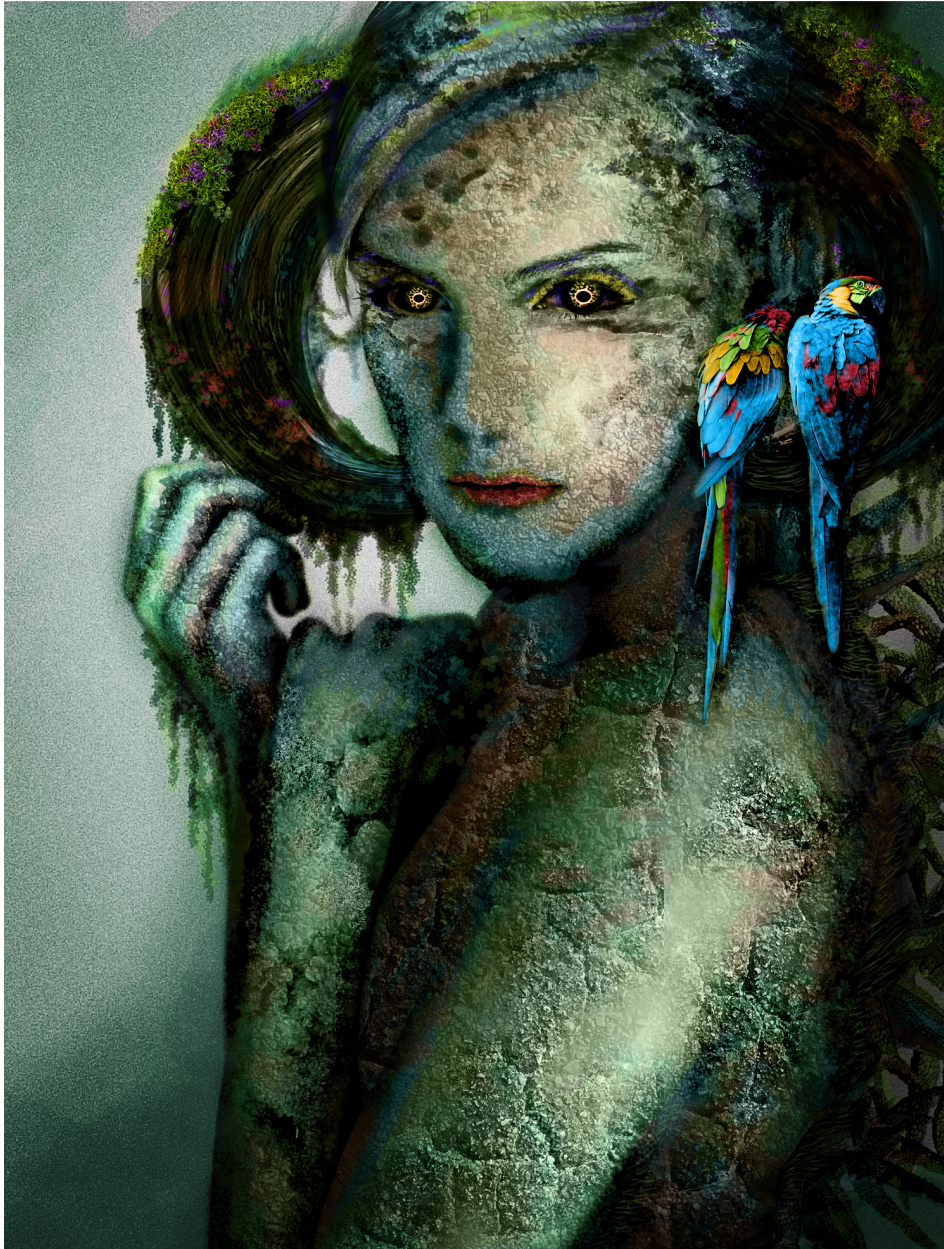
Design Ideation

Using a real time rendered film visually demos my game environment: desert. This demo film will include ground and underground world and 4 distinct times of a day: early morning, noon, late evening and midnight. When the camera moves through the scene, the environment will show the hints which indicate how to interact in this environment.

Design Concept My Art Style



Character Painting Illustration- Personal Focus



Forest Character Painting Illustration- Personal Focus



Digital Illustration Personal Work



Digital Illustration Personal Work





Still Life3D Visual Design



Toys Design Collection 3DDG Shading

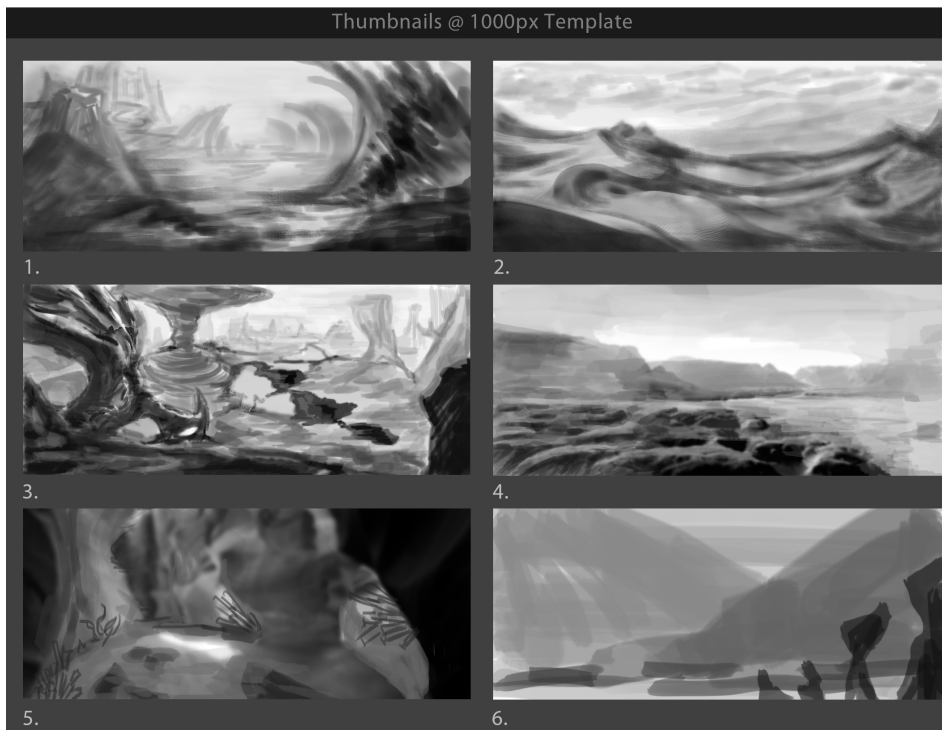


Destroyed Urban Scene 3DDG Lighting



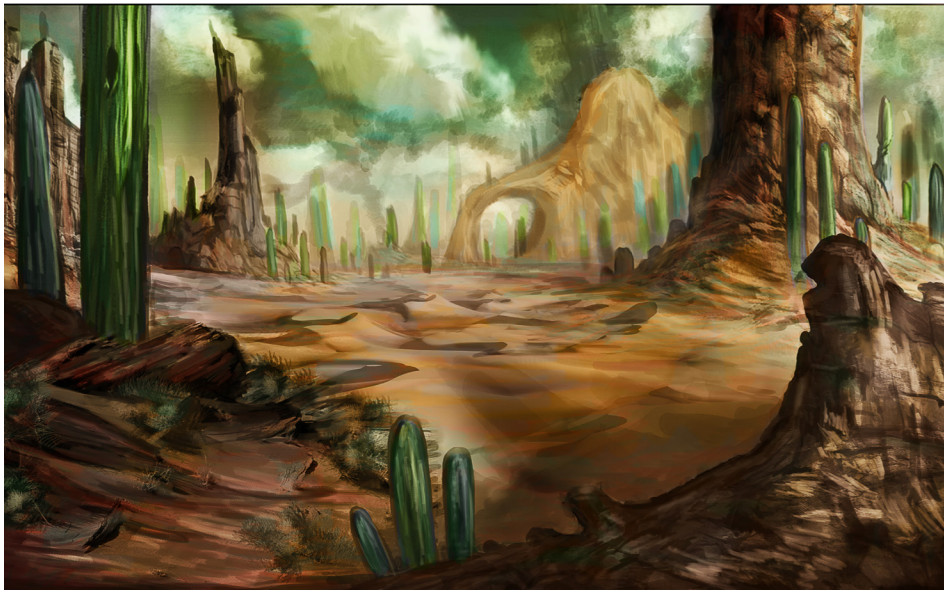
3D Sculpting Working in Progress Production Pipeline

Thumbnails

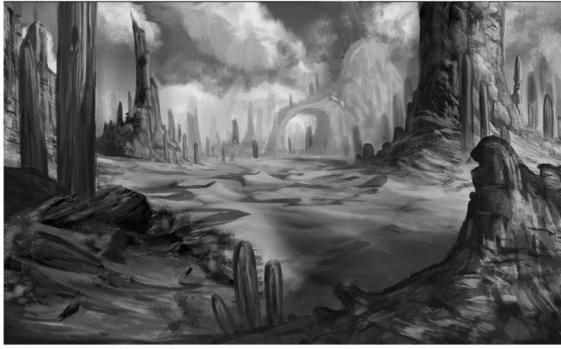


Experimenting on the possibilities of my desert environment

Concept Art

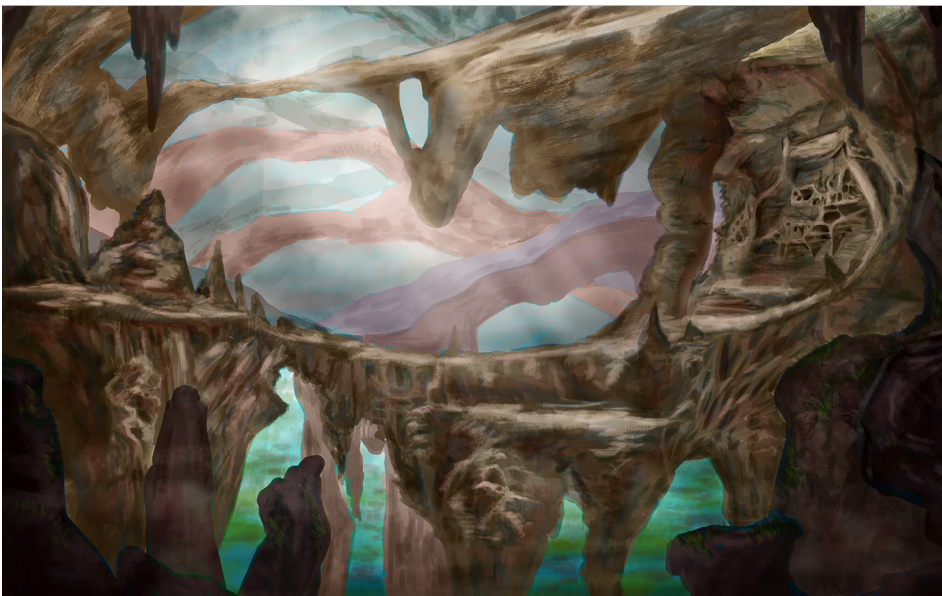


Ground World Concept

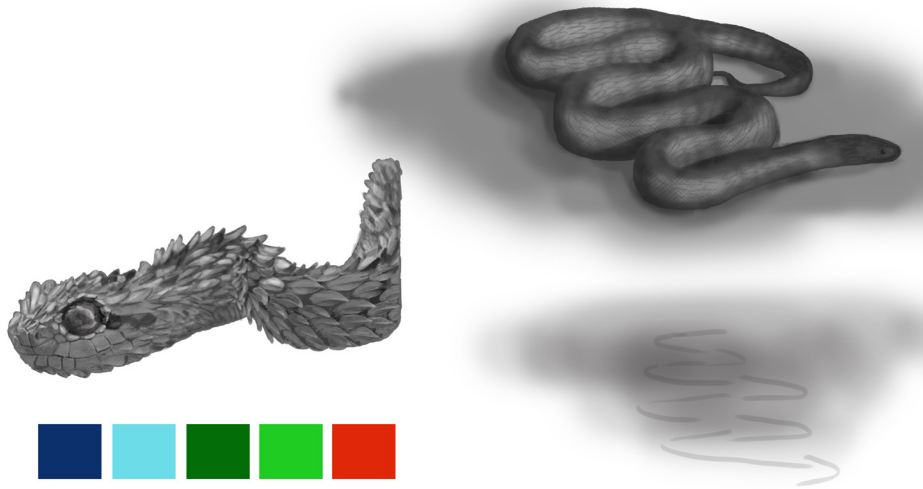


The color schemes of four different times of a day

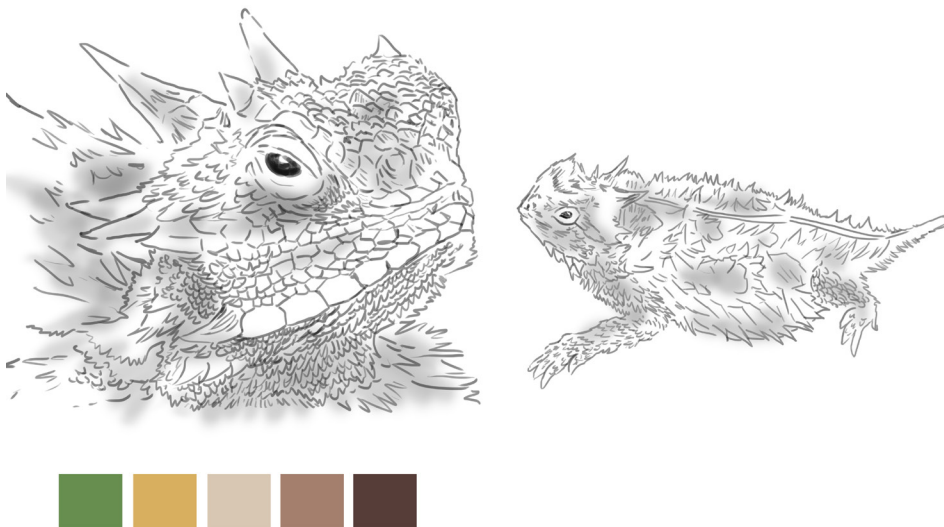
In the morning, the species in desert is most abundant. Because there is dew in early morning, players can collect crystalized sand and use it to protect themselves. At noon, most animals disappear, and the plants become sharp and pointed. Gamers can follow the desert foxes which habitat in cave to find out the underground world. In late evening, most large mammals appear, players can get heavy fur or hides to help them survive during night. At midnight, some nocturnal animals will appear.



Underground world concept



animal concept- snake



animal concept- lizard



animal concept- caracal

Thesis Proposal Oil Painting 3D Scene: A Desert Survival Game Environment



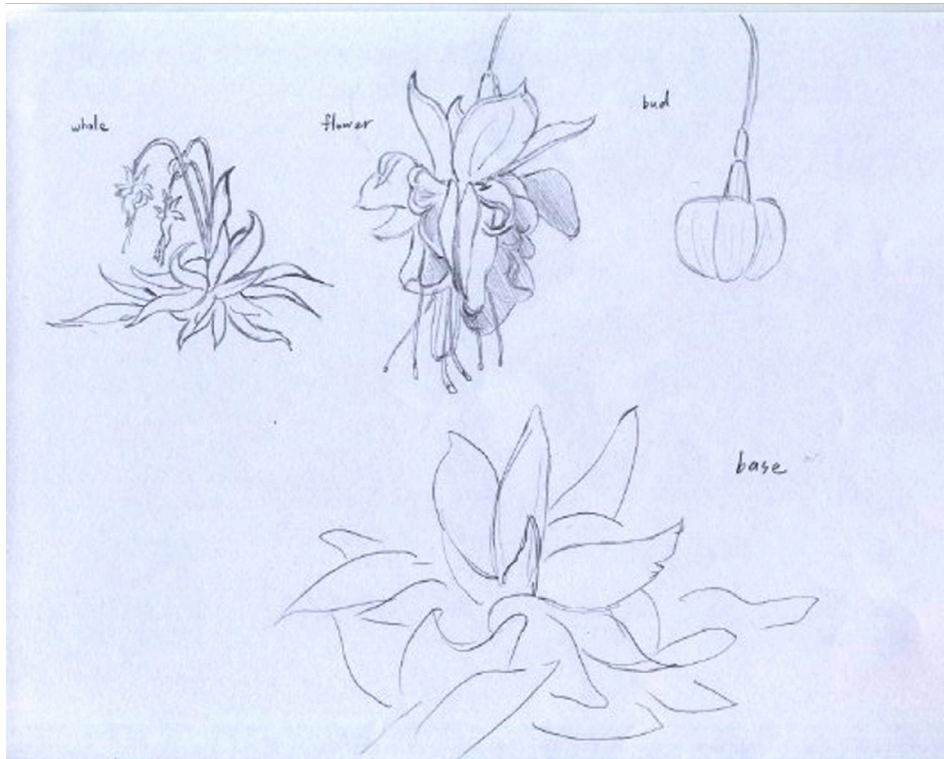
animal concept- spider



plant concept- cacti

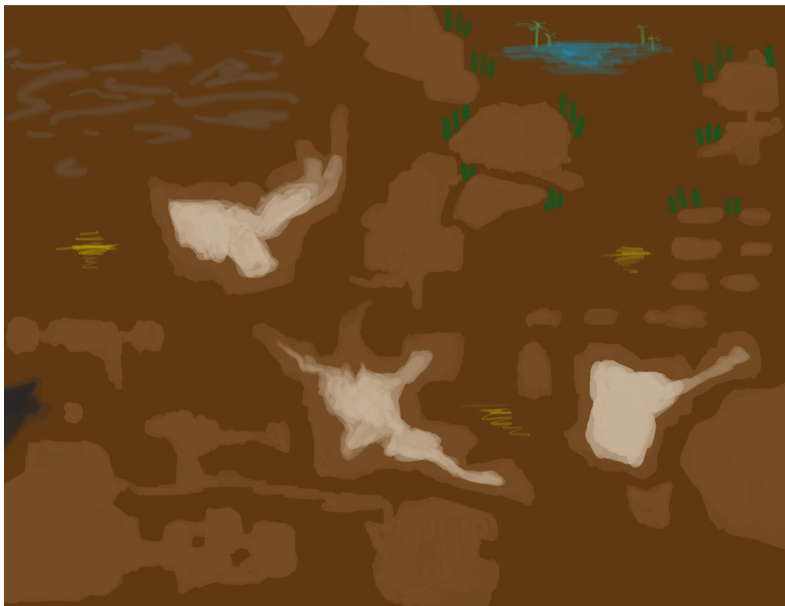


plant concept- fantasy plants



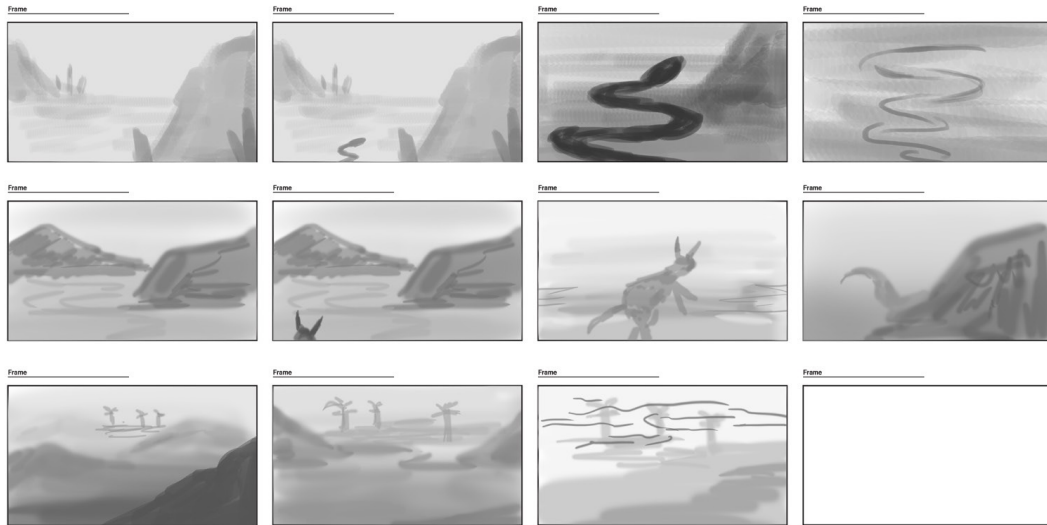
plant concept- flower rough sketches

2D Map



Short Movie clips example

This is a overhead 2D map. The darker area is the plain sand, the lighter color are the canyon. The black area is underground world entry. Yellow area is mirage.



Methodological Design

My thesis will be a 3D-based game environment with hand-painted textures built

Format: short movie clips of my environment

Audience: 12-18 male and female

Estimated Length: 01:00-01:30

Anticipated Software: MayaZBrush, headus-UVLayout-Pro Marmoset, dDo, nDo, XNormal, Adobe Photoshop, Adobe After Effects, Unreal Development Kit

Deliverables

Numbers of Models: An overall plane of sand, A oasis cityCanyons:
rocksAnimals: spider, lizard, caracal, fox and snake Plants: cacti, fantasy plants

Lighting Reference: Chiaroscuro style lighting Artist Caravaggio art works

Shading: hand-painted textures

Output: A demo film of my environment, 1:00 to 1:30 minutes

Implementation Strategies

Technical Foundation: 3D Modeling, 3D Shading, 3D Texturing, 3D Lighting, 3D Rendering, 3D sculpting, UV-unwrapping, Unreal Development Kit

I will use Digital Tutors and Gnomon Workshop to develop my other technical aspects:

Particle System and rigging in Unreal Development Kit.

Dissemination

Competitions: 3D Environment Competition by e-on3D, Game Model Challenge by CG Trader, Adobe Design Achievement Award, CGChallenge & NVartView Award—Best Environment Design

Websites: Vimeo Youtube

Social Networking: Facebook Twitter LinkedIn

Forum: Polycount CG society 3Dtotal

Evaluation Plan

I will create online surveys, analysis of the feedback be qualitative and quantitative. I will also exhibit my thesis in Imagine RIT event and Polycount forum to gather the feedback from the audiences.

Pragmatic Consideration

Travel expense: Conservatory in Highland Park: 50

Software: Marmoset-99, dDo-79, nDo-49

Timeline

10/2013___Thesis proposal draft

10/2013___Concept sketches and 2D map

10/2013___Movie clips sketches finished

10/2013___Thesis proposal

11/2013___Thesis blog started

12/2013___1st committee meeting

12/2013___Content finalized

12/2013___Create the questionnaire

01/2014___Base of the environment done

01/2014___2nd committee meeting

02/2014___Thesis report online

02/2014___All models and texturing done

03/2014___3rd committee meeting

03/2014___Texturing and Lighting done

04/2014___4th committee meeting

04/2014___Final project complete

04/2014___Last committee meeting

05/2014___Pass Thesis Defense 05/2014___Thesis show

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